CONTENTS.

PAPERS FOR VOLUME VI., PART I.

Evidences of Uplift in the neighbourhood of Perth— Page
J. L. Somerville (with two plans and three photos) 5–20

Notes on Western Australian Lampreys—
W. B. Alexander (with two photos) 21

Notes on climbing of waterfall by Narrow-mouthed Lampreys at Beedelup Brook (with two photos.)—
D. A. Herbert 23–26

Notes on Occurrences of Boulders, possibly glaciated, near Leonora and Laverton—
E. de C. Clarke (with a photo. and a drawing) 27

Xanthorrhoea reflexa—A New Species of Blackboy—
D. A. Herbert 33

A New Species of *Daviesia* from Western Australia—
Edwin Cheel 35

Aboriginal Names of Animals of the Lyons River District—
W. B. Alexander 37

Principal Indigenous Plants of Economic Importance—
W. B. Alexander, C. E. Lane-Poole, and D. A. Herbert ... 41

REPORTS ON EXCURSIONS.

1. To Perry's Limekilns—16th August, 1919 47
2. To Gingin—13th September, 1919 48
3. To Lake Yangebup—14th October, 1919 49
4. From Swan View to Darlington—18th October, 1919 50
5. To Lesmurdie Falls—1st November, 1919 52
6. To Greenmount—15th November, 1919 53
7. To Garden Island—6th December, 1919 54

LIST OF PLATES.

Mr. J. L. Somerville's Paper—
Plate I.—Map of Swan River 17
„ II.—Contour Map of Crawley-Nedlands Spit 18
„ III.—Cliff Section at "The Coombe" 19
„ IV.—Upraised Spit at Point Roe 20
„ V.—Cliff Section at Minim Cove 20

Mr. D. A. Herbert's Paper—
Plates VI. and VII.—Lamprey ascending a waterfall 25, 26

Mr. E. de C. Clarke's Paper—
Plate VIII.—Boulder Bed in Mallee Creek 31
„ IX.—Plan showing position of Boulder Bed 32

Mr. W. B. Alexander's Note on an Excursion to Garden Island—
Plate X.—Limestone Arch at North End of Island 57

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PHYSIOGRAPHIC NOTES FROM THE UNIVERSITY OF WESTERN AUSTRALIA.

No. II.—EVIDENCES OF UPLIFT IN THE NEIGHBOURHOOD OF PERTH.

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(*Read 9th September*, 1919.)

Table of Contents.

	Page.
Introduction	6
Principal Units in Physiography of the Perth Area	6
Evidence of Extensive Subsidence	7
Physiographic Elements in the Lower Swan Valley	7
Evidences of Small Superimposed Movement of Elevation... ...	8
Details of Raised Beach Structures	8
(1.) Shell Beds	8
(2.) Beach Breccias	12
(3.) Uplifted "Spits"	12
(4.) Beach Platforms associated with Uplifted "Spits" ...	12
(5.) Wave Cut Platforms	15
Summary of Conclusions	15
Explanation of Plates	17

Introduction.

The fact of a recent relative uplift of the coastline has been recognised in many places on the Western Australian coast. Uplift has been shown in Western Australia from the Great Australian Bight round the coast to Broome. Apparently the uplift has in

no case been the subject of careful measurement, but it seems to be of the same order as that indicated in the present paper for the Perth area.

The bibliography of the subject is given in Jutson, J. T., Physiography, Bull. No. 61, Geol. Surv. of W.A., p. 175.

The present paper is the outcome of a suggestion by Professor Woolnough given in the course of lectures, and the writer desires to tender his best thanks to Professor Woolnough for much kind help and many suggestions.

Principal Units in the Physiography of Perth Area.

The most striking feature of the country round Perth is the well marked Swan Coastal Plain. It is bounded on the east by a fault escarpment, the fault dividing the plain from the so-called "Darling Ranges." A better name is, as suggested by Jutson, the Darling Peneplain. The sea borders the plain on the west. It is very level throughout, only near the coast does it reach an elevation of 200 feet. The surface rock is entirely recent, right from the foothill of the escarpment to the coast. This applies more particularly to the Perth area; at Gingin cretaceous rocks have made their appearance. Starting at the fault and going westwards, sand is the commonest soil, with no hard rock outcropping. This is interbedded with alluvials of the various rivers which rise in the hills: the brickmaking clays from Bellevue to Guildford are examples of these alluvials. The sand is well shown in section in any of the railway cuttings between West Subiaco and West Guildford. The soil is grey, and the subsoil yellow, no solid rock appearing at all.

Further west a distinct belt can be recognised. It is characterised by the presence of abundant concretionary travertine in the superficial layers. The travertine always overlies æolian sandstone, and the lime of the travertine has certainly been derived from the sandstone by the agency of underground water in the manner described by Simpson for the origin of laterite.*

Forming the actual seashore are very recent dunes, composed of loose drifting sand, in which no cementation has taken place at all. Further inland, and often partially submerged by the new ones, is an older series of dunes: notable members are Buckland Hill and the larger hills around Fremantle. The railway cuts several between Cottesloe Beach and North Fremantle stations. The surface of these hills is always covered with the usual irregular travertine. Below this is the sand or friable sandstone, which is usually strongly current-bedded. Near the surface this sandstone contains many roots which have usually been encased by concretionary calcium carbonate. In the cuttings and quarries, the soft sandstone

* Simpson, E. S. "Laterite in Western Australia," Geol. Mag., 1912, p. 400.

has been weathered away from around these roots, which stand out in consequence. Mount Eliza lies well outside this belt, but exhibits all the characteristics just enumerated, and therefore may be a remnant of an earlier series of dunes lying further inland. These dunes offer comparatively little resistance to forces of erosion, being composed of a partially soluble rock (sand grains cemented with calcium carbonate), and therefore they would be rapidly removed from the landscape. Possibly by reason of its size or of some other factor affecting the rate of erosion, Mount Eliza should be the last of this series of dunes to disappear and merge into the general sandy formation of the district. The same remarks apply essentially to Mount Henry on the Canning River.

Evidences of Extensive Subsidence.

Many bores have been put down in the area, and they show rocks of the same type as those above described—alluvial, sand, etc., for a depth of 2,000 feet at least. The area is therefore one of extensive subsidence. The physiography of the Swan River also confirms this, because of its evident drowned character. This feature of the Swan River has been repeatedly noticed in the literature of the subject. Therefore, for some considerable time past, the Swan Coastal Plain has been subjected to a dominant downward movement.*

Physiographic Elements in the Lower Swan Valley.

The Swan River can be divided into two distinct parts:—

(1.) The section extending from Fremantle to the Causeway, in which the phenomena of a drowned valley are very distinct; and

(2.) The rest of its course, in which the normal features of river development are dominant. This part has not suffered to any marked extent from the drowning of the first part.

The drowned part can be again divided into two sections: (1) from Fremantle to Point Walter on one bank, and Claremont on the other, and (2) from these points onwards to the Causeway. In the lower section, from Fremantle to Claremont, the banks of the river are mainly lined with cliffs, and the river itself is narrow and of uniform width; whereas in the upper section, from Claremont to Perth, low shores and shelving beaches are the rule, and also the banks recede in places, resulting in the formation of broad "waters" and promontories.

*For fuller discussion of this subject see Jutson, J. T., Miscellaneous Report 30, Bull. No. 48, W.A., Geol. Surv., and Jutson, J. T., Physiography of Western Australia, Bull. No. 61, W A., Geol. Surv.

Evidence of a Small Superimposed Movement of Elevation.

Very recently there has been a slight elevation superimposed on the general subsidence. The evidence is supplied by raised beaches, which are common enough round the shores of the Lower Swan and on the neighbouring ocean beaches. These raised beaches are of several different types:—

(1.) *Shell Beds.*—These are bands of incoherent sandstone thickly crowded with shells, all of which are closely allied to, if not identical with living forms in the neighbouring waters. Several such bands may be seen in a single section, separated by layers of normal sandstone. By reason of their form and origin (which will be dealt with later) the amount that they have been uplifted can be readily measured. The highest bed of this type is the highest raised beach of the area, and is 22 feet above high water mark.

(2.) *Beach Breccias.*—These structures in a consolidated form are often associated with shell beds. The rock fragments, of which they are composed, were perhaps derived from rocky points or headlands rising from the beach.

(3.) *Uplifted "Spits."*—A different type of raised beach is illustrated by the "Spit" of the Swan River. A normal "spit" has certain well marked characters which are easily recognised when it has been uplifted.

(4.) *Beach Platforms associated with Uplifted "Spits."*—The "spit" often merges on its flanks into narrow beaches or platforms. These are generally found at the foot of a cliff, and range in width from 5 to 30 or 40 feet. Such beaches can be recognised not only at present river level but also in considerably uplifted positions.

(5.) *Wave-cut Platforms.*—Wave-cut or marine platforms are common on the ocean beaches of the area, and show varying amounts of uplift.

Details of the Raised Beach Structures.

(1.) *Shell Beds.*

There are very numerous occurrences of the shell beds, some are shown in natural section such as cliffs, and others have been exposed by artificial means in quarries, etc. In an earlier section of this paper the physiographic elements of the Lower Swan Valley were dealt with and a section of the river from Fremantle to Claremont was differentiated from the rest. This is the only part of the river in which outcrops of shell beds are known to occur. This fact probably has an interesting bearing on the physiography of the Swan River.

At about the centre of this lower part of the Swan is *Minim Cove* (A on map), and here an interesting series of beds occur in a cliff section. The shell beds are horizontally stratified bands lying conformably with sandstone above and below. Each band is

crowded with shells in a matrix of very friable sandstone. In some cases the sand is entirely unconsolidated. The shells are mainly lamellibranchs, usually with their two valves united as in life, the interior being filled with sand and shell débris. These bands alternate with sands from below low water mark to a height of 16 feet above high water mark. The beds attain a maximum thickness of 2 feet and their distance apart is of the same order. Of course the sand and shellbeds merge into one another, there being nothing in the nature of a sharp line of demarcation between the two. About two or three chains down the river bank another bed makes its appearance; it is only two or three inches wide but is quite horizontal and is of a similar nature to the wide bands below it. This bed is the highest met with at this place and is 17 feet above high water mark. It is covered by over 20 feet of dune sandstone, which is current-bedded and of typical dune origin. Evidently after the formation of this highest bed, sand dunes had advanced and obliterated the beach.

At *Hinemoa Rock* (B on map) a shell bed outcrops in the face of the cliff there. It is very similar to those at Minim Cove. It is 15 feet 6 inches above high water mark and there are 4 or 5 feet of sandstone above it. At Peppermint Grove (C on map) similar beds outcrop in the cliff faces. They show an uplift of 19 feet. There are several of them outcropping, and one merges into a beach breccia, which contains rounded fragments of large shells. This will be referred to later.

Near the jetty at Mosman's Bay (D on map) excavation has disclosed a shell bed. It is approximately 10 feet above high water mark. The assemblage of shells here is slightly different from that at Peppermint Grove and altogether different from that at Minim Cove.

There is an interesting section at "The Coombe" (E) between Mosman's Bay and Hinemoa Rock. Two beds are seen here but they are not horizontal. The lower one is a typical shell grit mixed with sand. There are few whole shells and these are of robust make, able to stand the buffeting of waves on a shore. At the north end this bed slopes upwards more steeply and changes in character. The shell fragments become larger and are smoothed and polished. Among them are limestone pebbles, and at the bottom of the bed these increase in number and the beds merge into a limestone breccia. These two structures adjoin a mass of rock which was certainly in the nature of a rocky point on the beach. On top of this rock a few shells are scattered and these are similar to those above the breccia. This rocky mass is of bedded sandstone and is coated with a layer of travertine in places. The sandstone shows curiously contorted laminæ in several places. They are folded fairly simply and the best explanation of this seems to be that they are caused by the slipping of an original quicksand, due to some

inequality of pressure. The nature of the shell bed and the presence of water-worn shells and pebbles point to the conclusion that here we have an original ocean beach with a rocky point, flanked by sand which overlies a beach breccia of limestone. A considerable quantity of shell grit was strewn over the beach, the whole structure thus resembling exactly a common present-day type of occurrence. Above this formation is more sandstone until another shell bed is met with at about 20 feet above high water mark. This bed also slopes upwards towards the north end. It is about 1 foot in thickness and the shell composition approaches that of the Minim Cove beds, and has little in common with the other bed immediately below. The north end of this higher bed is 23 feet above high water mark. This is the highest raised beach that has so far been found and therefore 23 feet is the greatest ascertained uplift.

In *Blackwall Reach* and on the right bank of the river there is a conspicuous cliff (F), and there is good evidence of uplift here. About 20 feet above high water mark and in a particular part of the cliff is a formation that is somewhat like a wave-cut platform and is overlain with beach sand and shells. Immediately below the 20-foot level the rock is a fine-grained solid limestone, merging further down into sandstone. The upper surface of this limestone is remarkably level over a considerable area. This is altogether unlike the normal travertine surface, which is characterised by sharp pinnacles of travertine or "niggerheads," due primarily to weathering. Above the 20-foot level and lying on this flat limestone surface is a very coarse sandy grit. This grit has a few smooth shell fragments in it, which, however, are broken up so that recognition of the species is quite impossible. There is a thickness of about 2 feet of this grit whose position agrees closely with that of the uplifted shell bank on the other side of the river.

Above this raised beach is about 6 feet of æolian sand covered with travertine. There can be no doubt that this was an ocean, and not a river beach, for the grit is very coarse (many grains are .4 cm. in diameter). They are quite rounded and smooth, as are also the shell fragments present. Some of these latter are much larger, being 5 or 6 cm. in their greatest dimension. The individual sand grains are mainly of quartz, though a large percentage are calcareous and of organic origin.

Other occurrences of raised shell beds have been recognised on the ocean beach between Fremantle and Cottesloe, and also at Rottnest Island.

There are three rocky points on the beach between Fremantle and Cottesloe, the first is at the *Cable House, Cottesloe Beach* (G), the second, at the *Bathing Sheds, Cottesloe Beach* (H), and the third is at the *Cottesloe Jetty* (J). At the Cable House the bed is a shelly, sandy limestone, the relative proportions of shells, sand, and secondary calcium carbonate varying between wide limits. The

rock is generally fairly hard and well cemented. This bed is only a little above high water mark, being barely out of reach of the winter storms, but is 5 or 6 feet above ordinary summer high tide mark. This bed is on top of a wave-cut platform which will be mentioned later. At the bathing sheds, Cottesloe Beach (H) an exactly similar bed occurs, being of the same composition and is about the same height. At Cottesloe Jetty (J) numerous shells are to be found in the rock there up to a height of about 10 feet in places. These shells are rather sparsely shattered in the sandstone but they definitely indicate that originally the latter was beach sand.

At *Rottnest Island* only a small portion of the ocean beach has been examined—that part from the main settlement to the west point of the bathing pool; but abundant and clear evidence of uplift is available even in this restricted area. At the west point of the bathing pool is a bed of sand and shell which shows a clear uplift of 5 feet above the highest tide mark. The material consists of round and smoothed pebbles of rock, of coarse sand, and of round smooth fragments of shells, which are varieties identical with those on the present day beaches. The whole mass is entirely unconsolidated and is overlain directly by dune sand. Noteworthy here also is the occurrence of ripple-marked sandstone, a structure which, for some reason, is rather rare in the area under consideration. In the present instance it does not appear to have been very definitely uplifted.

Below the lighthouse is another unconsolidated beach rubble, containing large shell fragments and this has been uplifted to about 10 feet above high water mark.

This completes the list of the more important occurrences of the beds so far examined. They are roughly of two types; the first type is a conglomerate or grit containing large or smooth fragments of big shells, such as would resist the battering action of the surf. This type is exemplified in the raised beaches of Rottnest Island, at the cliff in Blackwall Reach (F), at "The Coombe," (E), and at Peppermint Grove (C). The most robust and typical shell in these conglomerates and grits is Arca, which is an ocean type. The other type of shell bed is met with most typically at Minim Cove (A). The highest bed at "The Coombe" is of this type, as also are the beds at Peppermint Grove and Mosman's Bay. In these beds many of the pelecypods have the two valves united as in life, showing that these beds were beaches, comparatively undisturbed by heavy surf. At the same time shells such as Pinna and many gastropods have been washed up on to the shore, on top of the living lamellibranchs. It is noteworthy that a very perfect quartz crystal of the typical prismatic form, about 1.5 cms. in length, has been found in these beds at Minim Cove. The relative proportions of lamellibranchs, whose shells are still in the original position of growth, decrease considerably as we pass from the

Minim Cove beds to the beds at "The Coombe," Mosman's Bay, and Peppermint Grove, the decrease being in the order mentioned. Perhaps this shows that the beach was more sheltered at the Minim Cove end than towards Peppermint Grove.

(2.) *Beach Breccias.*

These are often connected with, and merge into, the shell beds, and thus have been described in part above. At "The Coombe" the breccia is of travertine mainly, though some sandstone fragments occur also. They are bound in a matrix of smooth-grained sand and the whole cemented with secondary calcium carbonate. At "The Coombe," and still more so at Peppermint Grove, there are some conspicuous black or brown limestone pebbles. Such dark-coloured limestone is unknown to the writer in the Perth District, but subsequently a macroscopically and microscopically similar rock was found in the limestone cliff at Deepdene, near Karridale, in the South-West of this State. There, it occurred as a vein in the limestone, and possibly the black limestone in the breccias had a similar origin. Fragments of shells are common in these breccias, which have been formed by wave attack on small cliffs and projecting rock.

(3.) *Uplifted "Spits."*

(4.) *Beach Platforms associated with Uplifted "Spits."*

These two subjects are closely related and it will be well to consider them conjointly. So-called "spits" are very common in the drowned part of the Swan River. The most typical one is at Point Walter. The main characters are a more or less pronounced headland, stretching out from which is a long narrow bank of sand. The bottom is fairly shelving at the sides, but at the end it drops down suddenly to deep water. The level of the sand is, unless disturbed by later currents, at the level of low water from the shore end to the extreme point.

The *South Perth Raised Spit.*—At South Perth, Mill Point more exactly, the evidence of uplift is very clear. All the essential structures are preserved. The Mill Point jetty is a very short one, but the end of it is in deep water. The road leading back from the jetty is level for a considerable stretch and then at Mends Street rapidly rises up a hill. The level stretch corresponds with the originally submerged sand spit and the hill is the original headland, having been dry land when the spit had not been uplifted.

The *Crawley-Nedlands Spit.*—Here the evidence is more complicated. The original spit was large and possibly it has been added to after uplift. On reference to the contour map (Plate II.) it can be seen that the contours, especially near the tramway, begin to close at about the 20-feet level. The land is gently rising up to

about the 20-foot contour and then the slope is increased, indicating a bank or original headland. This bank is somewhat broken in the neighbourhood of Ferdinand Street, but reappears further north and merges into the cliffs bordering the Perth-Fremantle road all the way to Perth. To the south the bank or headland merges into another cliff south of Nedlands. The flat area is narrow at the foot of both these cliffs and broadens west of Pelican Point. It is evident that here we have reproduced the characteristic form of a spit in an uplifted position. Low tide mark in a normal spit is just at the foot of the headland, and as far as can be judged by contour maps and inspection of the ground, the original low water mark is the present 20-foot contour. This indicates an uplift of 20 feet approximtaely.

At Crawley, in addition, a true spit is developed at the end of the uplifted one, either by accumulation of material since the uplift took place, or possibly by wave erosion. The waves of the river caused by the powerful "Fremantle Doctor," the sea breeze of the summer, and by the winter gales, would be quite competent to reduce the land by erosion, and to bring its surface to low tide mark, thus producing an ordinary spit. This process can be studied at the present day. The end of Pelican Point consists of a small bank two or three feet high. The foot of this is washed by high tide, and the sand is being worked downwards and outwards to at least below high tide mark.

Peppermint Grove.—There seems to have been a large uplift here. Probably Butler's Hump was originally a rocky mass joined to the mainland by a spit and a broad shelving beach. On uplift the whole was left dry and shows a narrow ridge on the river end, widening to a broad platform. The ridge and platform are approximately 12 feet above high tide mark.

Points Roe and Preston.—Typical spits are not developed here but different structures have been raised. Before uplift these were roughly triangular areas of shallow water, the sandy bottom being somewhat lower than low water mark. They were bounded on the land side by a steep abrupt headland. At both places this structure has been uplifted, forming a flat area of ground, but a few feet above water level. At the present time the same structure is being formed at the end of the old one. At Preston Point the contour map indicates an uplift of about 10 feet by an application of the same principles as were used in the case of the Crawley-Nedlands raised spit.

A structure similar to that found at Point Preston is seen at *Augusta*, on the mouth of the Blackwood River, and would doubtless be found at the mouths of many rivers and drowned valleys round the coast. At Augusta the flat upraised shallows are well shown on the same side of the river (a drowned valley here) as the settlement and between the latter and the actual mouth. These shallows are

here also continued into the water and end in a very sudden dip similar to that at the end of the Point Walter spit in the Swan. The uplift is of the same order of magnitude at Augusta as elsewhere.

At two places, at the Crawley-Nedlands Spit and at Point Preston, the uplifted areas grade from the type already described to a narrow platform running round the base of a cliff. This platform seems to have been a shelving beach in such a position that at high tide the waves washed the foot of the cliff. At Crawley this platform carries the Mount's Bay Road right round to the Esplanade. At Preston Point also the platform carries a road.

When the fact of an uplift has been established by other independent evidence it becomes easy to recognise uplifted structures. The flats around the Causeway are thus easily and readily explained and a similar remark applies to the flat at Augusta just mentioned. The characteristics of a typical occurrence are as follows:—(1) An almost perfectly flat area of land a little above water level. (2) This is bounded landwards by a steeply rising bank. (3) Towards the river there is a similar steep drop. In many cases this steep drop on the river side is not met with near the shore, shallow water may extend outwards for some distance, perhaps as much as a hundred yards from the shore. That is to say, the land surface shelves gradually from slightly above water level to slightly below it. Generally speaking this result may be caused either by an incomplete uplift of the spit or by a new sand bank being built up on the end of the old one. If a partially uplifted bank had originally a slight slope from the inner edge down to the outer edge, then the rise and fall of the river, due to tide or flood and the action of waves, would tend to degrade that portion of the land surface affected by these agents, and this would cause the formation of a wave-cut bank; it may be only a few feet high, at the high water mark. Examples are seen on the Crawley-Nedlands suit (Point Pelican), at Point Walter (near the land end of the jetty), and at many other places on the Swan, and also at Augusta.

Analogous structures on a large scale are seen on the Swan, particularly at the raised spit at South Perth and at Point Walter. They constitute the second characteristic of raised spits. The formation of these would be quite analogous to the smaller structures mentioned, for on the drowning of the Swan Valley, the new water level would often come part of the way up a sloping surface and the river would proceed to cut into the sloping bank by the action of waves and tide.

It is only necessary to mention other examples of raised platforms, spits, etc. They abound round the shores of the Swan up to the Causeway. Many of these upraised areas are shown in black on the map of the area. Near the two bridges at Fremantle are

extensive raised areas. An excellent example of a raised platform occurs near Nedlands and the old Men's Retreat. At Applecross a broad platform has been formed by river action.

(5.) *Wave-cut Platforms.*

There is still another class of phenomena showing the result of this recent epirogenic movement: the wave-cut platforms. The most perfect examples of these structures are to be seen at Rottnest Island. Near the settlement is a platform upwards of 100 yards in width. It consists of a flat surface of rock (sandstone and limestone) extending outwards from the shore and ending abruptly in deep water. These structures shelve very gradually, if at all, from the shore outwards. They are formed by wave attack, and thus the rocks of the land are reduced to the lowest level of effective wave action. This would certainly be well below low water mark. The erosion of a platform by waves would be faster between low and high water mark than it would at high tide mark itself, because the waves are acting for a longer time on the former portion. Consequently, it is probable that, in a platform of moderate width, the outer edge should be worn down to the lower limit of fast wave action, *i.e.*, low tide mark. Below low tide level the wave action is slower, because breaking surf is a faster abrading agent than the more slowly moving water we have below the low tide level down to the lower level of effective wave action. On many of the wave-cut platforms along the coast, particularly at the Cable House (G), and at Cottesloe (J), the outer edge of the platforms is being actively attacked, as is evidenced by the surf usually breaking there. It is therefore a fair assumption that these platforms have been slightly uplifted and they are therefore in the course of being planed down again. In two places, however, at the Cable House (G), and at the Bathing Sheds, Cottesloe Beach (H), platforms have been raised to more elevated positions. They are now recognised by residuals, in the form of a narrow shelf, a few feet higher than the present platform. These higher platforms are best seen in the winter time, in the summer they are partly hidden by sand.

Summary of Conclusion.

Superimposed on the extensive and universally recognised cycle of subsidence which impressed upon the Swan River Valley its characteristic features there has been a movement of elevation, amounting to at least about 23 feet. The evidences for this are as follows:—

(1.) In the vicinity of Cottesloe and North Fremantle there are numerous occurrences of *Shell Beds*, at heights above high water mark ranging up to 23 feet approximately.

(2.) Associated with these shell beds are *Beach Conglomerates* or *Breccias* having similar occurrences and significances.

(3.) On the shores of the lower part of the Swan River certain physiographic forms are recognised, described, and claimed to be uplifted spits. By a comparison with present day spits the amount of their uplift has been obtained approximately.

(4.) *Beach Platforms* also occur on the shores of the lower Swan River. They are often uplifted and the amount is easily determined by means of a comparison with the structure before uplift.

(5.) On the ocean beach between Cottesloe and North Fremantle *wave-cut platforms occur* which are shown to have been uplifted. The amount of uplift is rather indeterminate, but is of a small order of magnitude.

The shell beds are met with chiefly on that part of the Swan River lying between Claremont and Fremantle. It is shown that this section of the river is structurally distinct from the portion between Point Walter and the Causeway. The significance of this difference will be discussed in a later paper.

The mode of origin of the uplifted structures in process of formation in the river at the present time is discussed. Similar evidence of elevation at Rottnest Island and at Augusta is given.

Plate I.

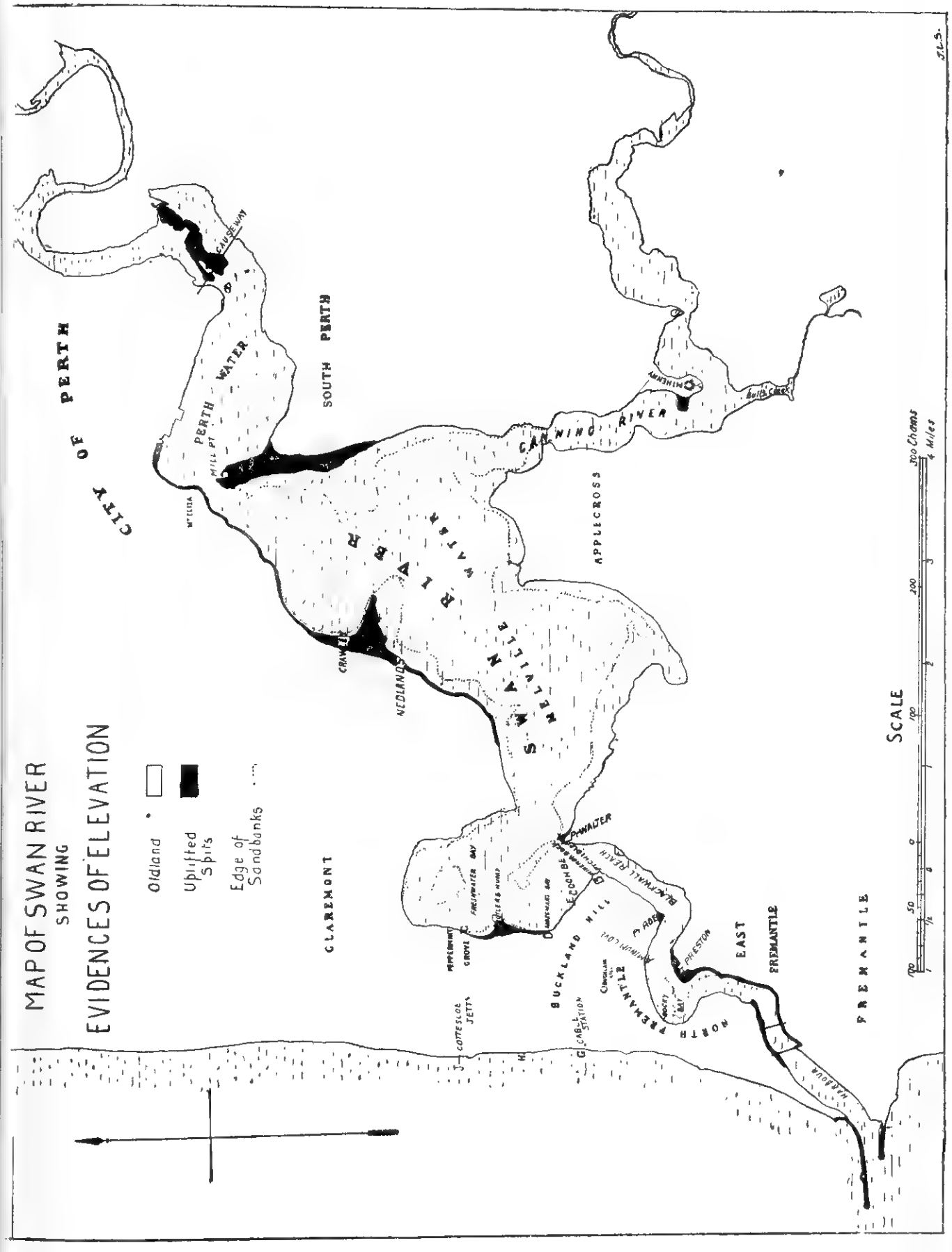
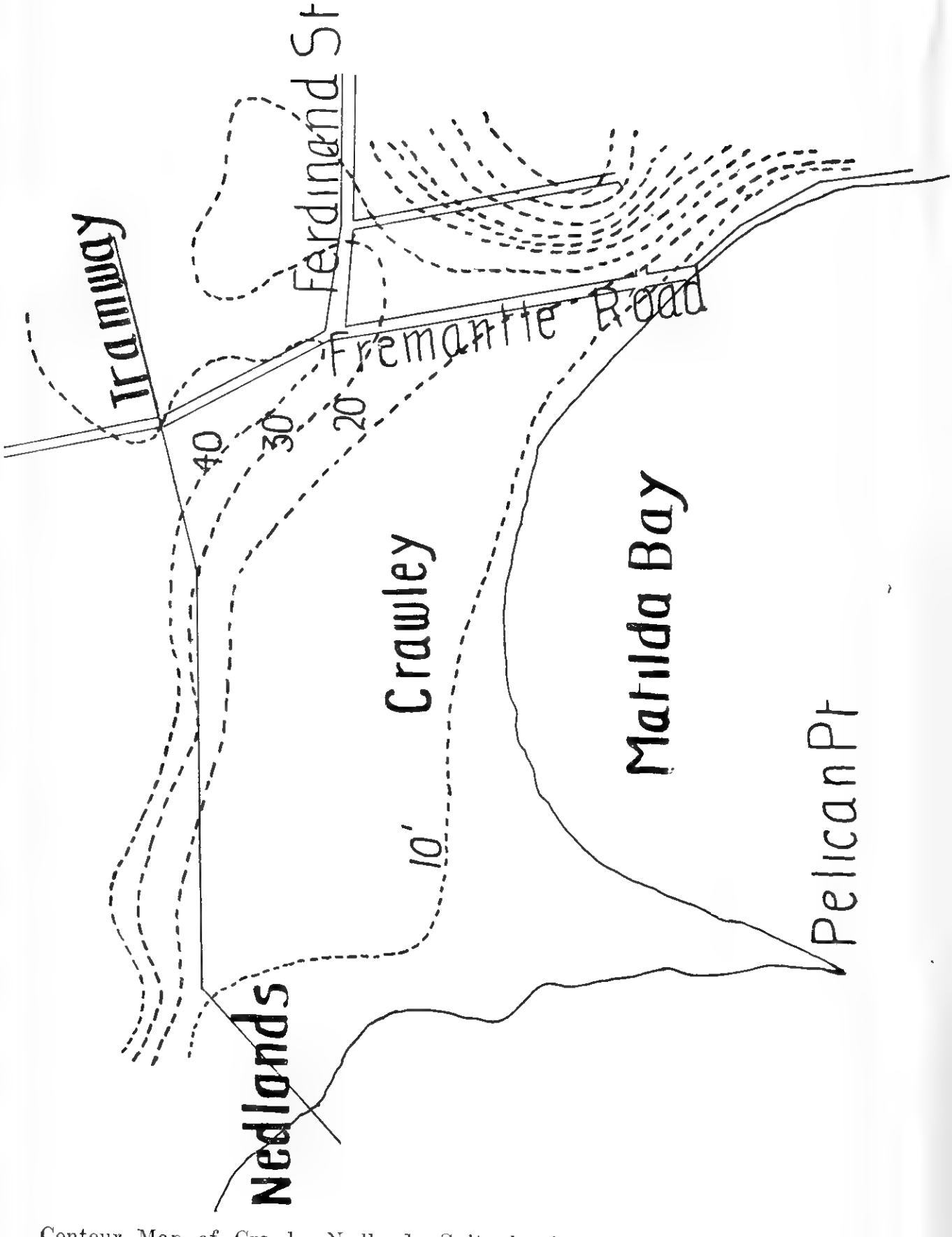
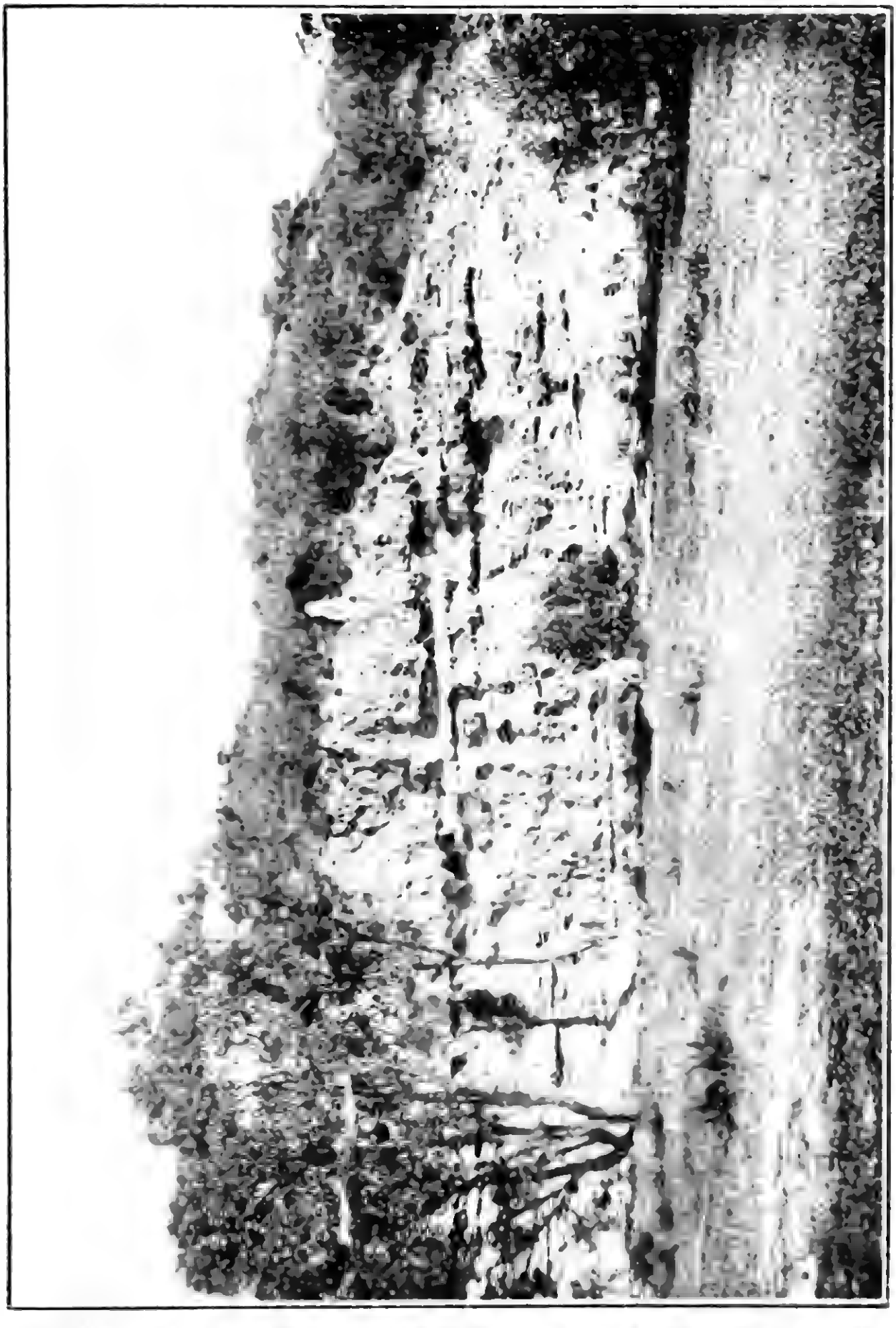

MAP OF SWAN RIVER
SHOWING
EVIDENCES OF ELEVATION
Oldland
Uplifted Spits
Edge of Sandbanks
CITY OF PERTH
SOUTH PERTH
PERTH WATER
CANNING RIVER
APPLECROSS
CLAREMONT
SWAN RIVER
FREMANTLE
EAST FREMANTLE
NORTH FREMANTLE
BUCKLAND HILL
SCALE
100 Chains
4 Miles

Plate II.



Contour Map of Crawley-Nedlands Spit, showing evidence of elevation.

Plate III.

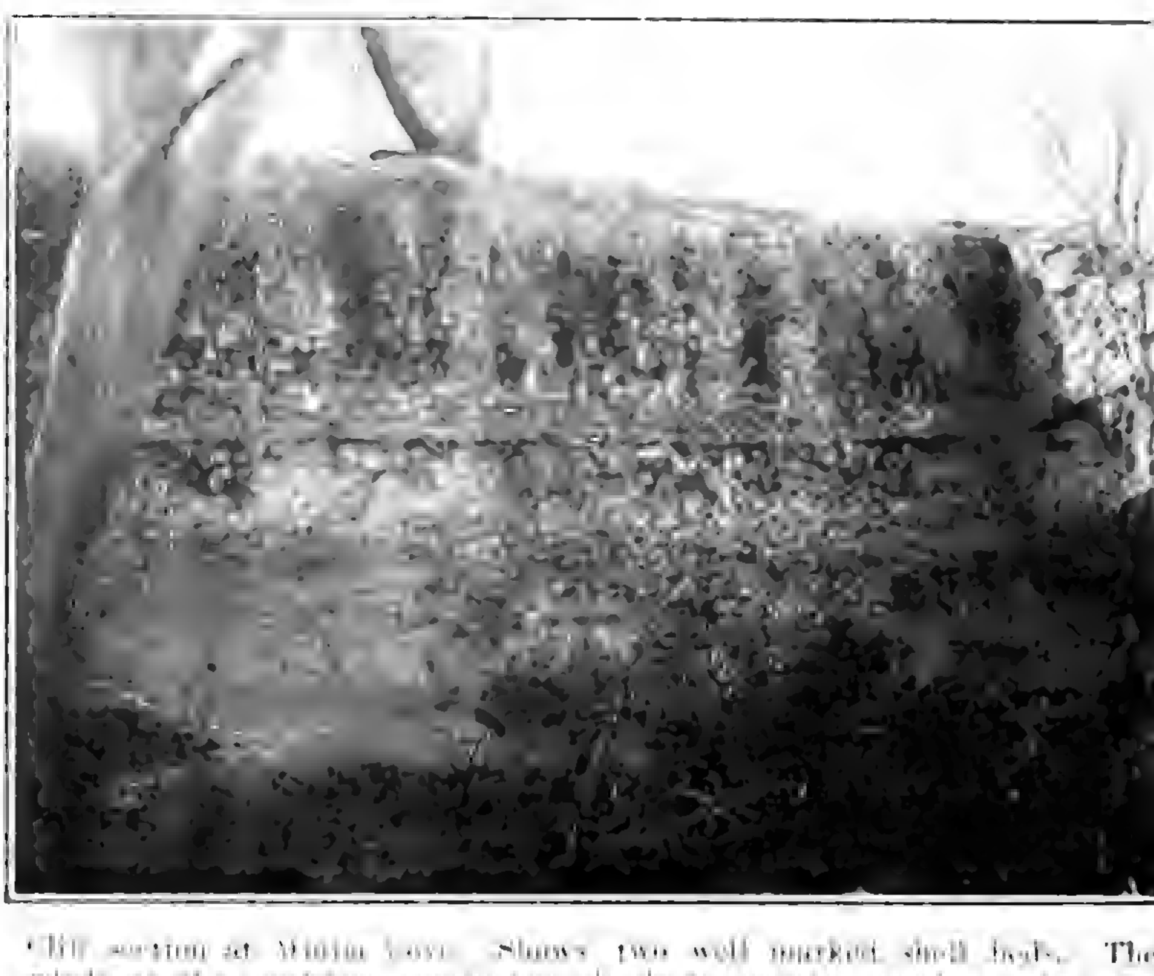


Cliff section at "The Conglie." Two well marked, nearly parallel lines can be seen in the cliff face. The upper one is the higher of two shell beds, and rises slightly to the north. The lower line is the other shell bed. To the left (south) it sinks below the ground level. To the north it rises and there overlies a structure interpreted as a rocky mass on the original beach.

Plate IV.

Exposed spot at [illegible] Bay. On the right is the scarp that which was the original sea bank, and on the left is the steep bank, the original coastline.

Plate V.



Cliff section at Mtoni bove. Shows two well marked shell beds. The whole of the sandstone comprising the beds contains numbers of shells,

NOTES ON WESTERN AUSTRALIAN LAMPREYS.

By W. B. Alexander, M.A., Keeper of Biology, W.A. Museum.

(*Read Oct.* 14, 1919.)

1. *General.*

As far as is known at present two species of Lamprey are found in the rivers of Western Australia, namely, the Wide-mouthed Lamprey (*Geotria australis,* Gray) and the Narrow-mouthed Lamprey (*G.* (*Velasia*) *stenostoma,* Ogilby).

Both these species are said to be found also in South-Eastern Australia, Tasmania, New Zealand, and Chile. It does not appear, however, that any worker has been in a position to compare South American and Australasian specimens, and until this has been done the specific identity of such distant forms must be considered doubtful. Should an examination prove that they are really the same, the name given to the Narrow-mouthed Lamprey of Australia by Ogilby (*Geotria stenostoma*) will become a synonym of *Geotria chilensis* of Gray. Dr. J. A. Leach,* the most recent writer on Australian Lampreys, uses the latter name, but I agree with Ogilby† that it is preferable to regard animals from two such widely different localities as distinct until they are proved to be identical.

The only comprehensive account of the Lampreys of Australia published hitherto is a Monograph by the veteran Australian ichthyologist, Mr. J. Douglas Ogilby, which appeared in the Proceedings of the Linnean Society of New South Wales for 1896† The more recent papers by Regan‡ and Leach* only deal with classification. It appears from Ogilby's paper that a single specimen of *Geotria stenostoma* from Swan River is in the British Museum, whilst Klunzinger recorded the occurrence of *G. australis* at King George's Sound. These two specimens are apparently the only ones hitherto known from Western Australia.

Both species appear to be fairly common in the rivers of the South-West, since there are in the W.A. Museum twelve specimens of the Wide-mouthed Lamprey and four of the Narrow-mouthed Lamprey.

Specimens of the former species have been received from Fremantle and Mandurah, and from the Serpentine, Collie, and Blackwood Rivers; whilst specimens of the latter have been received from Midland Junction and Harvey.

The breeding habits of the Australian species of *Geotria* are apparently quite unknown. It is known, however, that as in the European and North American species the larval form or ammocoetes is very different from the adult. The chief feature of their

life history that has attracted attention is their habit of travelling up rivers in swarms, and even negotiating waterfalls *en route* by means which are fully detailed in Mr. Herbert's record of his observations at Beedelup Brook. These migrations of lampreys were familiar to the Maoris in New Zealand, and on such occasions large numbers were captured, as they were regarded as a great delicacy. Similar migrations have been observed in Tasmania and Victoria. The distance to which they ascend from the sea is often very great. As an instance, I may mention that a specimen of the Wide-mouthed Lamprey was obtained in July, 1919, in the Blackwood River, near Boyup. Mr. F. T. Knapp informs me that to have reached the pool where it was obtained from the sea the Lamprey must have negotiated about 300 miles of waterway (allowing for the bends in the river), and some of the pools were only connected by about one or two inches of water over the sandy crossings, full flood not having commenced.

References.

(*) Leach. Species of Victorian Lampreys. Report Brit. Ass. Adv. Sci., Australia, 1914, p. 309.

(†) Ogilby. Monograph of the Australian *Marsipobranchii*. Proc. Linn. Soc. N.S. Wales, XXI., 1896, p. 388.

(‡) Regan. Synopsis of the Marsipobranchs of the Order *Hyperoartii*. Ann. Mag. Nat. Hist. series 8, Vol. VII., 1911, p. 193.

2. NOTES ON CLIMBING OF WATERFALL BY NARROW-MOUTHED LAMPREYS AT BEEDELUP BROOK ON FEBRUARY 10th, 1919.

By D. A. Herbert, B.Sc., Botanist and Plant Pathologist, Analytical Department.

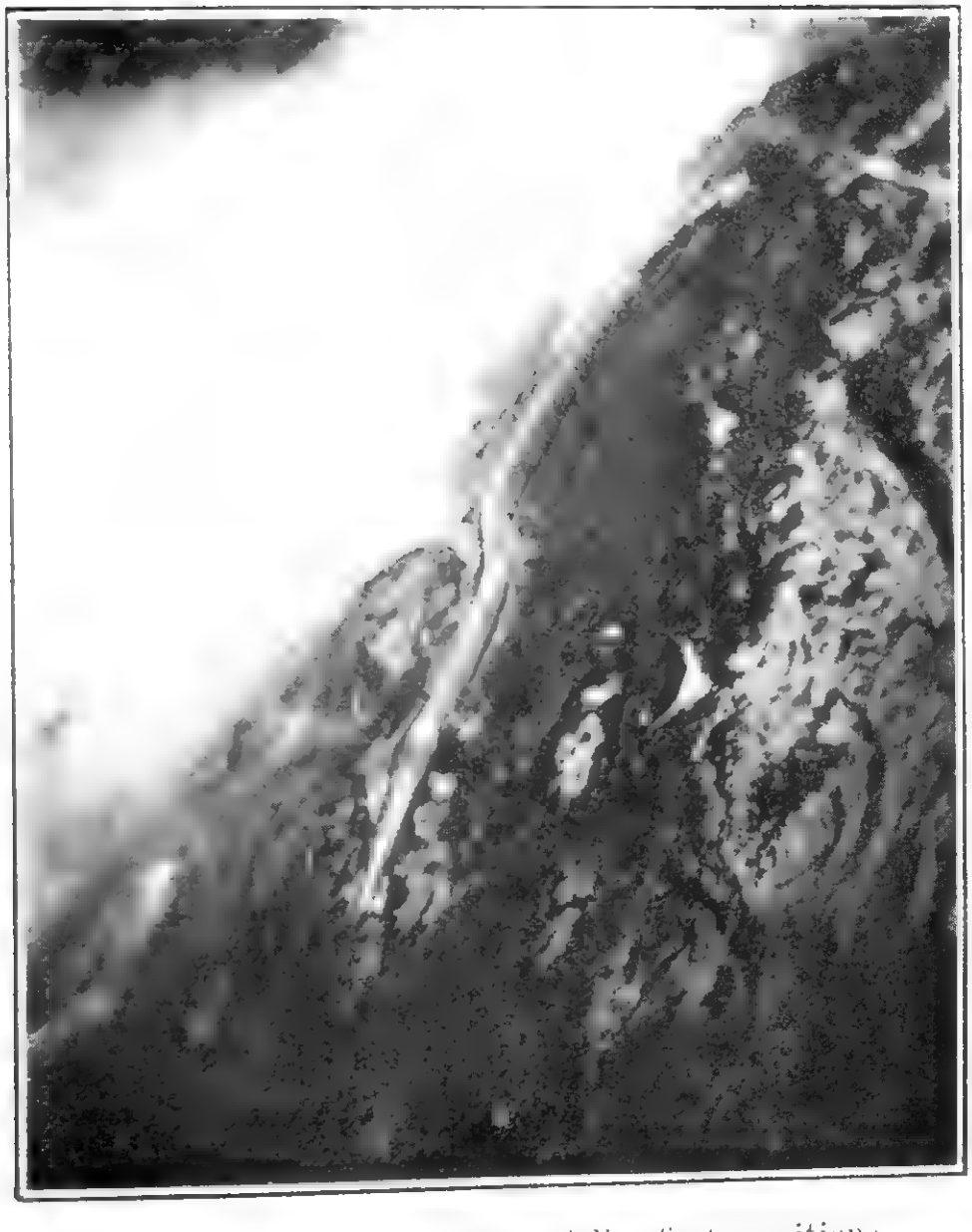
From the township of Pemberton, on the Big Brook, a road runs south, and about six miles down the Nannup Road runs off in a north-westerly direction. About 23 miles from Pemberton the road crosses Beedelup Brook, a small tributary of the Carey Brook, which flows into the Donnelly. Three hundred yards up from the crossing the brook comes down the hillside in a long series of waterfalls, some being 30 feet high. In the centre of the fall the water attains considerable force, but at the edges, where about two inches depth of water slide over the inclined plane of the rocks, the flow is much less rapid, and it was here that the lampreys were observed climbing. When first observed they were ascending one of the main falls of the series, where the water was shooting down a steep surface making 75deg. with the vertical and about 20 feet high. About 20 were making their way up this, and had already negotiated several smaller falls further down the hillside. The lampreys had a firm grip on the rock at the shallow margin of the fall and were gradually pushing their way upwards by a series of short jumps. To accomplish this the body was first bent (Fig. 1), suddenly straightened, and in nearly every case a new grip an inch or sometimes up to three inches higher was obtained. Occasionally, however, the animal failed to get a fresh grip, in which case it was swept down by the rush of water, sometimes right to the foot of the fall, though very often it would obtain a grip on the way down and resume its interrupted ascent. The ascent was spasmodic. After a series of jumps, resulting in an advance of two or three feet, the lampreys clung to the rock and rested for some minutes. They were unable to obtain any grip on dry rocks, and if the water was cut off from around them, by the placing of the hand above their point of attachment, for instance, they immediately lost their grip and shot away down the fall. Too strong a current, on the other hand, prevented them from ascending, for when they made a jump they would be swept back. The most favourable area seemed to be the margin of the fall under about two inches of water. This was enough to enable them to get a hold, and when they jumped the main part of the jump was accomplished in the air, so that the retarding action of the rushing water was minimised. A slight touch from the hand diverted their attention from the main business of

maintaining their hold on the rock. It was noticed that a large number were scratched and cut on the back, and this was probably due to accidents in the ascent, for the falls were rough, and a lamprey being swept down could easily be damaged on the jagged edges. It is just possible that some of the cuts were due to the attacks of gilgies or marran, because further down the stream in a small, still pool a gilgie was observed to attack a lamprey and give it a nip on the back.

Further search down the stream resulted in the finding of a number of other lampreys all heading up-stream. They were able to travel rapidly over dry rocks from one pool to another, or across small meanders in the brook, but as a rule preferred to travel by water. Of course, in ascending the falls, all the travelling was by water. About 50 were observed altogether, and these were all within a strip of the stream about a quarter of a mile long. The largest was about 2 feet 3 inches long and the smallest 1 foot 6 inches.

None of the local residents had observed lampreys before, either in Beedelup or any of the other brooks in the district, except Mr. Martin, of Pemberton, who said that some years ago he had seen several stranded on the flats of the Big Brook after a flood.

Plate VI.



Lamprey ascending a waterfall (first position).

Plate VII.

Lamprey ascending a waterfall (second position).

NOTE ON OCCURRENCES OF BOULDERS, POSSIBLY GLACIATED, NEAR LEONORA AND LAVERTON, ABOUT LAT. 28 30′ SOUTH.

By E. DE C. CLARKE.*

(*Read Nov.* 11, 1919.)

Superficial deposits of gravel, rubble, sand, loam, and laterite cover large areas in the country surrounding Leonora and Laverton, as they do in other parts of the Western Australian goldfields. These deposits vary in character according to the nature of the underlying rocks in the vicinity, from which they have evidently been derived by weathering. However, during the course of field-work in 1917-18, in the Leonora-Laverton country, I noticed deposits the constituents of which had clearly been transported some distance and which, being possibly significant of climatic conditions very different from those now obtaining in the district, appear to deserve notice.

Smoothed fragments of granite and quartz, varying in size from pebbles to boulders five feet in diameter, closely crowded together in a fine bluish-green clay, form the "country" from the surface to a depth of 44 feet in the Government Well at Mertondale near Leonora. All the boulders and pebbles are well rounded, but many have one side distinctly flattened. Although this boulder bed rests on a denuded surface of foliated quartz porphyry (containing in other places auriferous veins and probably contemporaneous with the main gold-bearing series of greenstones) it does not, as far as I noticed, contain fragments of this underlying rock, nor of the closely adjoining greenstones. Moreover, the granite of the boulders appears to me to be different from that of the nearest granite mass (about three miles to the north). Similar boulders are scattered over the flat between the Government Well and Merton's Reward G.M., and are found at the workings 12 miles and nine miles from Malcolm on the road to Mertondale. A few "colours" are rumoured to have been found at the base of a boulder deposit in another well at Mertondale which was inaccessible to me.

Boulder conglomerate occurs on the banks of Mallee Creek, about 25 miles north of Laverton, on the Laverton-Duketon track. (See Fig. 1.) In this place, however, blue-grey matrix is the prominent feature. boulders—which are of a foliated granitic rock—being rather few and far between. The conglomerate is overlain by 15 or 20 feet of recent sandy loam, the red colour of which is in

* By permission of the Director of the Geological Survey of Western Australia.

marked contrast to the prevailing blue-grey tint of the underlying rock. However, the absence of distinct bedding planes in both deposits makes it impossible to be certain whether or not there is an unconformity between them. The conglomerate is underlain by a greatly weathered rock, probably greenstone, with steeply inclined shear-planes. Here again then there is marked contrast between the underlying rock and that constituting the boulders of the conglomerate.

Mr. Tucker told me that, in sinking his well about a mile south of Mallee Creek, a bed, 46 feet in thickness, of rounded boulders (one of which, according to my informant, was 9 feet in diameter) embedded in bluish "clay" was passed through before "solid country" was encountered.

Between Tucker's and Cork Tree Well (two miles farther south), and again for about three-quarters of a mile before reaching Twelve-Mile Creek on the track to Laverton, rounded boulders, most of which are granitic, are scattered on the surface, as noticed previously by Mr. C. S. Honman.* The underlying rocks in this part are greenstones.

In the dump of the well on Twelve-Mile Creek, about one mile east of the Laverton-Duketon track, are rounded boulders of granite, greenstone, and porphyry, which show the characteristic flattening of one side. The well being full to the brim of rain water at the time of my visit, no further investigation was possible. The country surrounding the well is composed of fine-grained greenstone.

A few rounded boulders of granite were noticed about $1\frac{1}{2}$ miles west of Twelve-Mile Creek on an abandoned part of the light railway line which supplies the Lancefield G.M. near Laverton with firewood. The underlying country is probably greenstone.

Rounded granite boulders occur also along the Morgans-Mt. Margaret telegraph line, but, as the same type of rock crops out near by, this occurrence is not significant.

A few very smooth, rounded quartz pebbles were found among the ordinary quartz and ironstone rubble in the country west of McNie's homestead north of Darlôt, a considerable distance from localities already cited.

It appears, however, that between Mertondale and Malcolm, and between Mallee Creek and Laverton, well-rounded boulders not derived from rocks in the immediate neighbourhood are common.

No agency at present operating in this sub-arid region is competent either to transport these rock fragments from their original situation or to round and smooth them so remarkably, and it therefore seems probable that they are remnants of an extension of the "Wilkinson Range Series" of glacial beds, possibly of late Mesozoic

* Formerly one of the Field Geologists, Geological Survey of Western Australia.

or early Tertiary Age, which has been found about 150 miles farther east.*

I did not find on these boulders any undoubted scratches such as occur on the Wilkinson Range specimens, but it is noticeable that some show facetting rather than simple rounding, and that, on the flattened side, which many boulders show clearly, quartz and felspar crystals have, despite their unequal hardness, been equally worn down to form a plane surface.

The rock comprising the uppermost part of a small isolated peaked hill about four miles south of the Ida H. gold mine, near Laverton, is described by Mr. R. A. Farquharson† as an extremely fine-grained clay consisting of mica scales and quartz grains. He adds that the rock shows no signs of stratification but was probably produced by the sorting action of water. The country on which this hill stands is composed of epidiorites and porphyrites, belonging to the main (gold-bearing) series of greenstones. The fine-grained material is probably, therefore, a peculiar type of superficial deposit which, granted the glacial origin of the boulder deposits described above, may be a till belonging to the same series.

NOTE ON MR E. DE C. CLARKE'S PAPER.

Some recent additional geological information bearing upon the matter of the occurrence of boulder beds in the central portion of Western Australia has been made a month or two ago by Mr. H. W. B. Talbot in the country between Zanthus on the Transcontinental Railway and Laverton.

A series of horizontal sediments, arranged in terraces, were found along the banks of the upper reaches of the Ponton River; these sediments were associated with rounded pebbles and boulders of quartz.

Ten miles north-east of Mount Dennis was a horizontal conglomerate thickly studded with quartz boulders and pebbles resting on an uneven surface of granite. A series of arkoses and grits were found to overlie the conglomerate in conformable sequence. These beds were lithologically identifiable with those in the Wilkinson Range near S. lat. 26deg. The Wilkinson Range beds consist of compacted sandstones and claystones, about 100 feet thick, underlaid by a boulder bed. The boulders are of all sizes and generally agree in shape, with one conspicuous flattened side, occasionally covered by such scratchings and markings as result from ice action. Large boulders weighing 2 cwt. and more are by no means uncommon. The Wilkinson Range beds have been traced for a distance of about 200 miles.

* H. W. B. Talbot and E. de C. Clarke, G.S.W.A. Bulletin 75, p. 105, and Journ., Royal Society, Western Australia, Vol. III., p 80.

† Petrologist, Geological Survey of Western Australia.

The Wilkinson Range beds have as yet yielded no fossils, so that their position in the geological time scale cannot be definitely fixed at present.

These observations in the three widely separated localities are of considerable geological importance, as showing the great extension of this formation in a southerly direction, and its relation to the beds which make up that extensive plateau known as the Nullabor Plain.

It is, on structural and other grounds, highly probable that the beds referred to by Mr. Clarke in his paper, and those met with by Mr. Talbot, form the western extension of the boulder beds met with in the bore at the 337-mile 61-chains peg on the Transcontinental Railway Line at a depth of 1,372 feet below the surface, or about 800 feet below sea level.

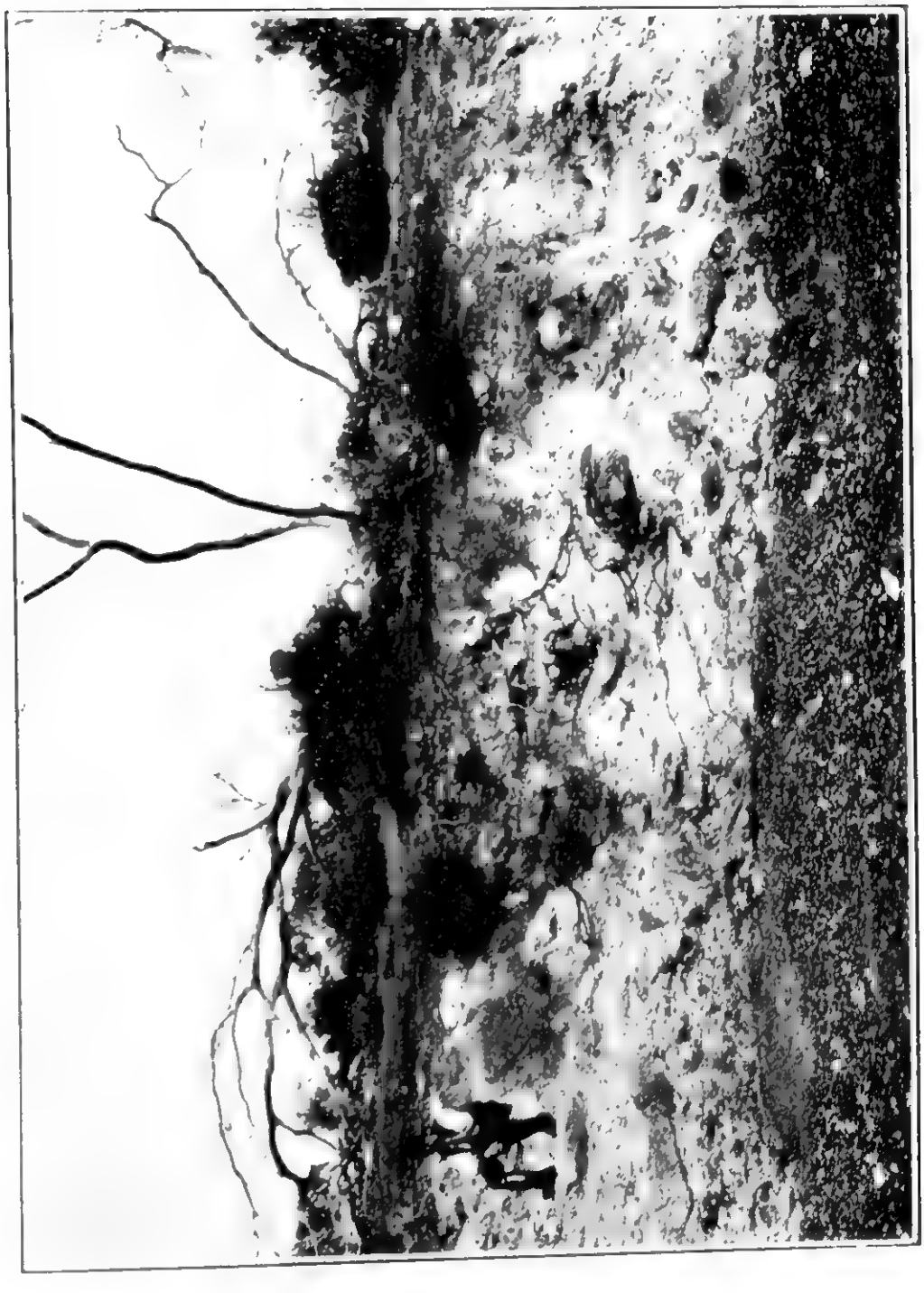
The rocks beneath the Eucla limestone of Tertiary Age, met with in the bore, have yielded two of the most characteristic fossils found in the lower cretaceous strata of South Australia and Queensland, viz., *Aucella hughendensis*, Eth. fils.; *Maccoyella corbiensis*, Moore, together with portions of a bivalve shell, possibly *Fissilunula*, which is also found in the Lower Cretaceous beds of Eastern Australia. There seems to be little doubt, therefore, that the strata pierced in the bore in question are the equivalents of the Rolling Downs beds of Queensland, and that the beds were deposited in that sea, which during this period divided the continent into two portions, viz., the Eastern, or what may be called Asiatic Australia, and the Western Australian Australia.

The occurrence of glacial deposits in Australia, during the Cretaceous period, was first suggested by Sir (then Mr.) Douglas Mawson in 1907, in a paper read before the Australian Association for the Advancement of Science, hence the importance of the recent observations by Messrs. Clarke and Talbot.

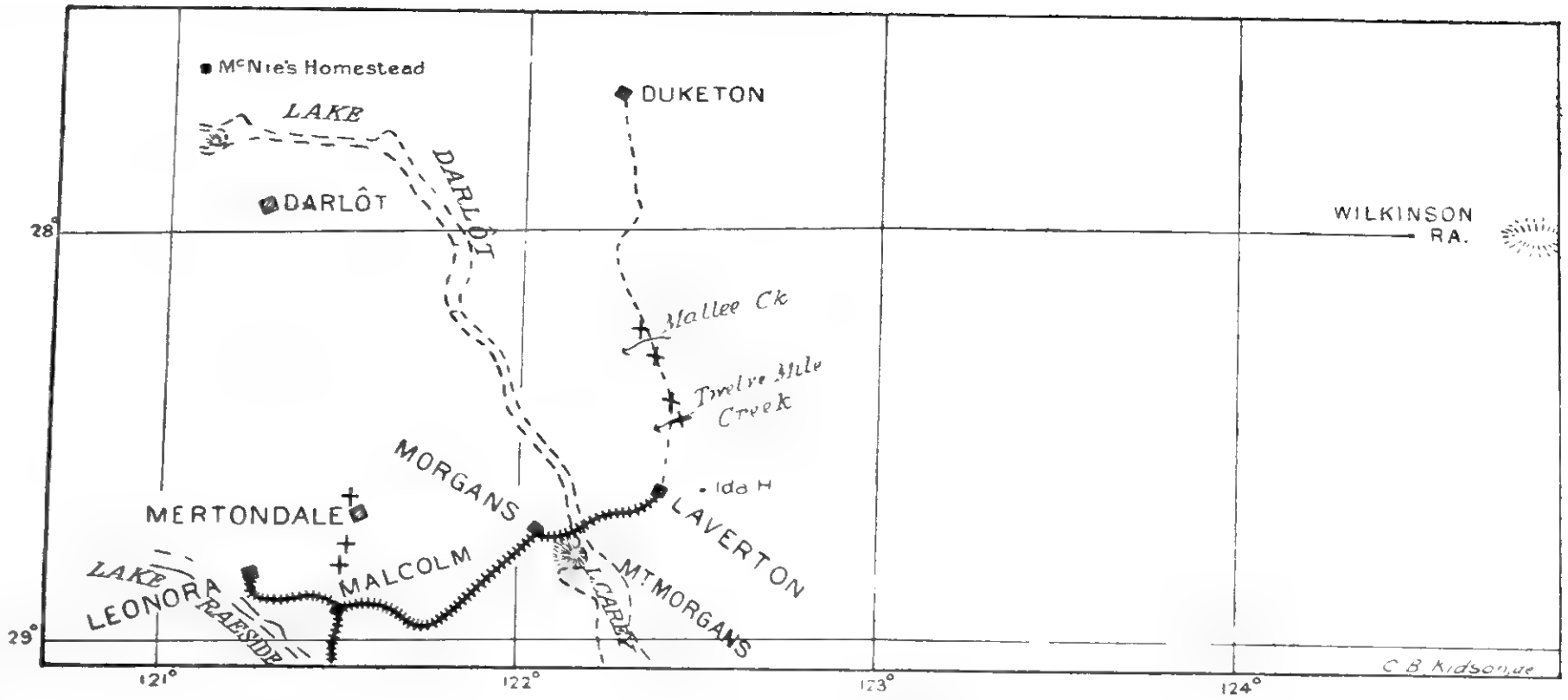
It is, however, noteworthy that the Permo-Carboniferous glacial deposits of Western Australia occur in about similar latitudes.

A. Gibb Maitland.

Plate VIII.



Boulder Bed in Mallee Creek, 25 miles north of Laverton.



SKETCH MAP

SHOWING POSITION OF

BOULDER DEPOSITS

Scale

0 25 50

Approximate position of deposits shown thus +

Plate IV.

XANTHORRHOEA REFLEXA: A NEW SPECIES OF BLACKBOY.

By D. A. Herbert, B.Sc., Economic Botanist and Plant Pathologist, Analytical Department, Perth.

(*Read Dec.* 9, 1919.)

Caudex—thick, simple or branched, and ranging in height up to ten feet or more, the core (consisting of leaf trace bundles), with a hard, woody cone up to 18 inches in height at the base, the upper part tough and fibrous but not woody, and surrounded by the persistent leaf bases.

Leaves—quadrangular, rather brittle, but not snapping off as do those of X. *Preissii*, passing into a curved, flattened base 2½ to 3 inches long.

Base of Leaves—persistent, 3½ to 4½ lines broad, 2½ to 3½ inches long, curved and turning downwards at the tips, hence the specific name.

Gum.—covering the leaf bases, dark brown or black, from the effect of bush fires, and giving to the leaf bases a typical black appearance. In plants unaffected by fires the colour is not much darker than that of *Preissii*.

Scape—as in X. *Preissii* about 1 inch thick when mature and up to about 6 feet long, of which more than half is occupied by the spike.

Bracts—both outer and subtending ovate-oblong or lanceolate, prominent only in the young spike.

Bracteoles—linear—spathulate, nearly as long as the perianth.

Perianth Segments—4½ lines long, the outer thin, rigid, oblong, and concave, the inner broader (1½ to 2 lines), with a short spreading membranous apex.

Stamens and Capsule—as in X. *Preissii*.

Localities—Blackboy Hill; Wedin (East of Narrogin); Popanyinning, Capel. Not very common in the Perth district but common further south.

The new species comes very close to X. *Preissii*, the most common species of blackboy, but differs in the caudex, persistent leaf bases, leaves, and perianth segments. An important difference is that of the gums exuded by the two forms. The outer layer of the caudex, which consist of the persitent gum-impregnated leaf

bases, is widely used for fuel purposes, and that of the new species is much preferable to that of X. *Preissii* as it is more inflammable. Analyses of the gums have not yet been published, so the exact nature of the chemical difference of the two species is still unknown. Chemical composition is as important as morphology in determining many species, particularly in the case of the Eucalypts, and the part played by it in evolution is generally lost sight of.

Though the leaf bases of X. *reflexa* burn better than those of X. *Preissii*, it is to be noted that bush fires do not have the same effect on the plants in the field. The new species resists fire fairly well, whereas the leaf base layer of the common blackboy is frequently deeply channelled by it.

The principal differences between the two may be tabulated as follow:—

	X. *Preissii*.	X. *reflexa*.
Inner perianth segments	Slightly more than 1 line broad	1½ to 2 lines broad.
Leaves	Generally triangular or diamond shape in section	Quadrangular.
Leaf bases	Flat and roughly horizontal, about 1 inch broad and varying in length from 2 inches	Curved and reflexed making an angle of 45° with the caudex, 3½ to 4½ lines broad and 2½ to 3½ inches long.
Caudex	Woody cone at the base absent or small	Woody cone well developed.
Time of flowering ...	August to November in the hills around Perth	August to October round Perth.
Gum covering leaf-bases	Brown	Black.

On account of the close resemblance of the two there is no common distinguishing name for the new species, and that of Reflexed Blackboy is suggested.

ON A NEW SPECIES OF DAVIESIA FROM WESTERN AUSTRALIA.

By EDWIN CHEEL, Botanic Gardens, Sydney. (Communicated by J. H. MAIDEN, F.R.S., Honorary Member.)

(*Read Dec.* 9, 1919.)

Daviesia costata sp. nov.

Frutex glaber, 2–3½ pedalis, ramis basi nascentibus, erectus vel semi erectus, ramis et ramulis minus angularibus, distinctius striatis vel costatis Foliis planis, vinearibus vel linearilanceolatis, apico acuminatis, basi attenuatis 5–20 cm. longis, 4–6 mm. latis, nervis centralibus in ramuli angulari decurrentibus. Inflorescentia racemosus vel irregularibus umbellatiis, racemi gemini vel rarius fasciculiformibus, basi minute bracteati. Pedunculi 1–2½ cm. longe, pedicelli 5–10 mm. longe. Calyce distinctius costatis, quinque cum dentibus decurrentibus, quinque intermedius. Vexillum sub-orbicularibus et emarginatus, atro-purpureæ ad basi auranticum duplo longus alae et carinae.

A glabrous shrub varying from 2 to 3½ feet high, the branches arising from the base, erect or semi-erect, slightly angular, but distinctly ribbed or striated. Leaves flat, linear or linear-lanceolate, acuminate, varying from 5 to 20 cm. long, and from 4 to 6 mm. broad, with a strong central nerve or midrib, which runs more or less continuously down the attenuated base of the leaf and decurrent with the angules or ribs of the branches. Inflorescence usually racemose or irregularly umbellate, in pairs, or in clusters of four or sometimes more, in the axils of the leaves, the main peduncle varying from 1 to 2½ cm. long and the pedicels usually 5 to 10 mm. long, or occasionally both the peduncle and pedicels are longer, chiefly owing to the suppression of some of the flowers. When distinctly umbellate there are usually three or four, or rarely more flowers arising from the same point, and at the base of the pedicels there are a pair of bracts, the others being suppressed; but when the flowers are racemose, each flower has a minute bract at the base of the pedicel. Calyx distinctly costate, the five primary ribs extending and continued with the minute calyx-teeth; and five ribs intermediate between these main ribs. Standard sub-orbicular in general outline but distinctly emarginate, dark purple on the back and margins and orange at the centre and base, usually about as long again as the keel and wings, which appear to be of an orange or dark yellow colour. Pod acuminate, about 10-12 mm. long, 5-7 mm. broad, with a solitary brownish-coloured seed having a broad strophiole.

This species seems at first sight to closely resemble *D. Wyattiana*, Bailey, and may be classed in section Racemosae, as the flowers are on the whole more racemose than umbellate. It also somewhat resembles *D. longifolia*, Benth., but the leaves of the latter are very prominently striate and much narrower than those of the proposed new species.

The chief distinction between the eastern species (*D. Wyattiana*) and the proposed species is that the inflorescence is not so strictly umbellate and the branches and branchlets are not so strictly angular as in *D. Wyattiana*.

This new plant was first collected at Queenswood, on the preston Valley Railway, by Mr. Max Koch in October, 1910; and bears the No. 2041. It has since been collected on sandy places in open jarrah forests, six miles from Donnybrook, in October, 1912, by the same collector.

ABORIGINAL NAMES OF THE ANIMALS OF THE LYONS RIVER DISTRICT.

By W. B. Alexander, M.A., Keeper of Biology, W.A. Museum.

(*Read Dec.* 9, 1919.)

In April, 1918, I had the interesting experience of conducting round the W.A. Museum three full-blooded aboriginals from the district where the Lyons River flows into the Gascoyne. These aboriginals were in the employ of Mr. Rutherford, who has a station in that locality, and who had brought them with him to Perth. They had never been in the city before, and the oldest could speak very little English. One of the younger men appeared to be highly intelligent and could speak English fairly well.

They were greatly interested in the animals in the Museum collection, and readily picked out those found in their own district. For some of these the younger men knew no aboriginal name, but the oldest man seemed to have a name for everything he recognised except the Black-breasted Plover (*Zonifer tricolor*), which they stated had only appeared in the district within the last few years. I am satisfied that the names given me are *bona-fide*, especially as a number of those given to birds are the same as those in use near the North-West Cape as recorded by Mr. T. Carter, and several of those for animals are similar to words from neighbouring localities given in Curr's "Australian Race." The difficulty of transcribing aboriginal names into English is well known. The method I adopted was to repeat the word given me until the aboriginals were satisfied that I had got it right and then to put it down and repeat it once more. In general the consonants should be pronounced as in English, the vowels more as in French.

The following is a list of the animals recognised:—

Mammals—

Dingo (*Canis dingo*)—Napara.

Bats (*Chiroptera*), all species including Flying-foxes—Koralyajee.

Kangaroos and Wallabies. Four species occur in the district, viz.:—

Red Kangaroo (*Macropus rufus occidentalis*)—Maloo.

Rock Kangaroo (*Macropus robustus cervinus*)—Bigoora.

Hare-Wallaby (*Lagorchestes hirsutus*)—Warrawya.

Rock Wallaby (*Petrogale lateralis*)—Wallangya.

Opossums. Only one species found in the district, viz.:—

Common Opossum (*Trichosurus vulpecula*)—Wyulda.

Phascogales, several species—Mandagory.

Bandicoots. Only one species found in the district, viz.:—

Rabbit Bandicoot (*Peragale lagotis*)—Yilgai.

Native Cat (*Dasyurus geoffroyi*)—Teroro.

Echidna (*Tachyglossus aculeatus ineptus*)—Jirrybarry.

Birds—

Emu (*Dromaeus novaehollandiae*)—Yallobiddy.
Bustard (*Choriotis australis*)—Parderua.
Stone Curlew (*Oedicnemus magnirostris*)—Weelawodda.
Black-breasted Plover (*Zonifer tricolor*), has no native name. The bird has only recently appeared in the district.
White-fronted Heron (*Notophoyx novaehollandiae*) -Korlolba.
Black Duck (*Anas superciliosa*) -Wongona.
Mountain Duck (*Casarca tadornoides*) -Pedargorra.
Pelican (*Pelecanus conspicillatus*) -Bimba.
Wedge-tailed Eagle (*Uroaetus audax*) -Walada.
Goshawk (*Astur fasciatus*)—Charlalya.
Kestrel (*Cerchneis cenchroides*) Meginma.
White Owls (*Tyto alba* and *T. novaehollandiae*) Jarli.
Boobook Owl (*Ninox novae seelandiae*) -Korlba.
Red-tailed Black Cockatoo (*Calyptorhynchus banksi*) -Bildēra.
Galah (*Kakatoe roseicapilla*) Bilyendi.
Cockatoo-Parrakeet (*Leptolophus hollandicus*) -Weeroo.
Twenty-eight Parrot (*Barnardius zonarius*) Mabenga.
Budgerigar (*Melopsittacus undulatus*) -Kolyabiddy.
Blue-winged Jackass (*Dacelo leachi*) -Jarrooroo.
Bee-eater (*Merops ornatus*) Berulberul.
Sacred Kingfisher (*Halcyon sanctus*) -Perina.
Frogmouth (*Podargus strigoides*)—Toywee.
Black-and-White Fantail (*Rhipidura tricolor*) -Jindy-jindy.
Mr. Rutherford informed me that the familiar Wagtail or Black-and-White Fantail is regarded by the natives with great dislike and is killed whenever possible. The aboriginals confirmed this statement but gave no reason for their dislike.
Red-breasted Babbler (*Pomatostomus rubeculus*)—Doyndoyn.
Blue Wrens (*Malurus*, several species) -Yerreeyarro.
Wood Swallows (*Artamus*, several species) -Yalbonjarry.
Butcher-bird (*Cracticus torquatus*)—Wandoa.
Magpie (*Gymnorhina hypoleuca*) -Kurrbarro.
Grass-wrens (*Diaphorillas*) -Nyandi.
Bellbird (*Oreoica cristata*) —Bagobago.
Magpie-lark (*Grallina cyanoleuca*) -Jillinberri.
Pardalotes (*Pardalotus*)—Bawalilly.
Minah (*Myzantha flavigula*)—Beingy.
Crow (*Corous coronoides*)—Woggora.

Reptiles—

Giant Goanna (*Varanus giganteus*)—Wero.
Gould's Goanna (*Varanus gouldi*)—Yungolyi.
Blue-tongued Lizard (*Tiliqua occipitalis*)—Yarulla.
Stump-tailed Lizard (*Trachysaurus rugosus*)—Palarra.
Mountain-devil (*Moloch horridus*) —Nanarrai.
Spine-tailed Lizard (*Egernia depressa*)—Mēlyu.
Reticulated Lizard (*Amphibolurus reticulatus*)—Barollo.
Jew Lizard (*Amphibolurus barbatus*)—Belya.
Geckos (*Geckonidæ, all species*)—Tarra.

Reptiles (continued)- -

Large snake with black head, probably the Black-headed Python (*Aspidites melanocephalus*) —Molyarro.

Children's Python (*Liasis childreni*) —Waigur.

Snake like a Death-adder (*Acanthophis*)—Bolbo.

Fresh-water Turtle -Canderra.

The only turtle in the district is quite different from the Long-necked Turtle (*Chelodina oblonga*) from the South-West. Its neck is short. It is probably either Emydura macquarii or E. australis, but these species are not represented in the Museum collection so could not be shown them.

Crocodiles are unknown in the district.

Amphibia –

Frogs (*Hylidæ and Cystignathidæ, all species*) -Malgoora.

Fish- -

Only two kinds of fish are found in the district : -

Silver Perch (*Therapon bidyana*) -Kanma.

This species is found in all the waterholes.

Mullet (*Mugil dobula*) –Wiloworran.

This fish is found in the Gascoyne River as far up as the mouth of the Lyons.

CONCLUSION.

The foregoing vocabulary of animal names seemed to me worth placing on record, as it is probable that even those who are in constant touch with the natives in the district in question are unacquainted with the native names of many of the rarer animals.

I had thought of attempting a comparison of the Lyons District names with the native names of animals which have been recorded for other districts, but have not at present the necessary time for such a work. A large number of animal names are given in Moore's Vocabulary, which deals specially with the aboriginal dialects of the Swan, Avon, Moore, Murray, Vasse, and King George Sound tribes. In Gould's great works on the Mammals and Birds of Australia the aboriginal names of the various species in the same region are given, having evidently been collected by John Gilbert. In Curr's "Australian Race," Vol. 1, the aboriginal words for certain selected objects are given for a great many West Australian localities. The animals selected by Curr are: Kangaroo, Opossum, Tame dog, Wild dog, Emu, Black duck, Wood duck, Pelican, Laughing Jackass, Native Companion, White cockatoo, Crow, Swan, Fish, Lobster, Crayfish, Mosquito, Fly and Snake. Mr. T. Carter, in his account of the birds occurring in the region of the North-West Cape, Emu, Vol. III., gives the aboriginal names of a large number of the birds, whilst Mr. G. C. Shortridge, in his paper on the geographical distribution of the Marsupials and Monotremes of South-west Australia also gives aboriginal names.

The following table shows native names for a few animals, taken from these sources:—

——	Kangaroo.	Opossum.	Emu.	Pelican.
DeGrey R. (Curr) ...	Mungaroo	Wallambine	Kullya ...	Ngurlawanda Wirmalo
Shaw R. (Curr) ...	Badjeerie...	Koobalyie	Yalliberry	Thudaarra
Nichol Bay (Curr) ...	Mungaroo	Wolumberree	Yallyberree	
N.W. Cape (Curr) ...	...	Marajaak...	Yallooberry Yallabiddee (Carter)	Kandannara
Lyons R. (Alexander)	Maloo ... Bigoora	Wyulda ...	Yallobiddy	Bimba
Upper Sandford R. (Curr)	Marloo ...	Wyadoo ...	Yalabiddy	Jilakarby
Sharks Bay (Curr) ...	Yowerda	Yoorda ...	Kaliat ...	Churuna
Mouth of Murchison (Curr)	Yowada ...	Weurda ...	Cullya ...	Marnbu
Northampton (Curr)	Yoorda ...	Kommale	Kallilia	Arranger
Geraldton (Curr) ...	Yooada ...	Waiada ...	Kulire ...	Knulum-berry
New Norcia (Curr)...	Yongar (m.) Wora (f.)	Cumal (m.) Cular (f.)	Wegie ...	Nirimba
South-West (various authors)	Yungar (m.) Worre (f.)	Koomul or Goomal	Widjee or Watcha or Waitch	Nerimba, Boodalan or Bootlung

This seems to indicate that the Lyons River natives use for the Opossum a name similar to that in use southwards to Geraldton. For the Emu they use a name which is found northwards, with slight modifications, to the DeGrey River. Their name for the Pelican seems to be peculiar to themselves. The two species of Kangaroo found in the district have special names, and this makes comparison with vocabularies in which a single name is given for Kangaroo decidedly dubious. It appears, however, that on the Sandford River the Red Kangaroo is known by the same name, whilst on the Shaw River the name for the Rock Kangaroo occurs slightly modified.

LISTS OF THE PRINCIPAL INDIGENOUS WEST AUSTRALIAN PLANTS OF ECONOMIC IMPORTANCE AND OF NATURALISED ALIENS AND WEEDS ESTABLISHED IN THE STATE, WITH THEIR VERNACULAR NAMES.

The accompanying lists were prepared at the request of the Commonwealth Institute of Science and Industry by a Committee appointed by the Royal Society of Western Australia. The members of the Committee were:—

Mr. W. B. Alexander, M.A., Keeper of Biology, W.A. Museum (convener).

Mr. C. E. Lane-Poole, Conservator of Forests.

Mr. D. A. Herbert, B.Sc., Economic Botanist, Government Analyst's Department.

The Council considered that these lists would be of interest to members of the society and others, and therefore decided to publish them. It is recognised that there are many other plants of some local economic importance which have not been included in the first list, *e.g.*, trees yielding timber used for fencing-posts or fuel, flowering-plants whose seeds are collected for local cultivation or export, and shrubs and grasses which are eaten by stock.

The vernacular names given in the lists are those which the Committee recommends for use in this State. Those for endemic plants are in almost every case names already widely known in the State, though in some few cases where the same plant is known by more than one vernacular name the Committee has chosen the one that seemed most suitable. Of the alien plants only a few have acquired local vernacular names and these have been adopted by the Committee except in cases where they were definitely incorrect. For the remainder the usual British text-book name has been given.

The Council of the Society, recognising that suitable vernacular names for the W.A. wildflowers would help to popularise their study, has asked the Committee to continue its work with power to add to its numbers. The Committee will welcome assistance from any person interested in this subject, and would be particularly grateful to anyone who would send in lists of vernacular names already in use in the district where he or she resides. Communications should be addressed to the Chairman of the Committee, Mr. C. E. Lane-Poole, Forestry Department, Perth.

LIST OF THE PRINCIPAL INDIGENOUS PLANTS OF ECONOMIC IMPORTANCE.

Scientific Name.	Vernacular.	Value.
Rutaceæ—		
Boronia megastigma ...	Sweet Boronia ...	Cultivated for its scented flowers.
Boronia elatior	Broad-leaved Boronia	Cultivated for its flowers.
Malvaceæ—		
Hibiscus Huegelii	W.A. Hibiscus ...	Ornamental shrub.
Sterculiaceæ -		
Sterculia diversifolia ...	Kurrajong	Ornamental tree and Fodder-plant.
Euphorbiaceæ- -		
Euphorbia Drummondii ...	Balsam Spurge ...	Poison-plant
Casuarinæ—		
Casuarina Fraseriana ...	Sheaoak	Timber used locally for cabinet work and shingles.
Salsolaceæ- -		
Atriplex semibaccatum ...	Salt-bush	Fodder-plant.
Atriplex nummularium ...	Old-man Salt-bush	do.
Nyctagineæ- -		
Boerhaavia diffusa	Tar Vine	do.
Leguminosæ—		
Oxylobium retusum ...	Bloom Poison ...	Poison-plant.
Oxylobium parvilflorum ...	Box Poison ...	do.
Gastrolobium bidens ...	Kite-leaf Poison ...	do.
Gastrolobium bilobum ...	Heart-leaf Poison	do.
Gastrolobium Callistachys ...	Rock Poison ...	do.
Gastrolobium calycinum ...	York-road Poison ...	do.
Gastrolobium grandiflorum ...	Wallflower Poison...	do.
Gastrolobium hamulosum ...	Hook-pointed Poison	do.
Gastrolobium ovalifolium ...	Gilbernine Poison ...	do.
Gastrolobium parvifolium ...	Berry Poison ...	do.
Gastrolobium spinosum ...	Prickly Poison ...	do.
Gastrolobium villosum ...	Crimp-leaved Poison	do.
Isotropis striata	Lamb-poison ...	do.
Templetonia retusa	Templetonia ...	Ornamental shrub.
Crotalaria Cunninghamii ...	Bird-flower ...	do.
Tephrosia purpurea	Pan-ja-da	Used by aborigines as a fish-poison.
Clianthus Dampieri	Sturt's Desert-pea	Cultivated for its flowers.
Kennedya nigricans ...	Black Kennedya ...	Ornamental climber.
Kennedya coccinea	Coral Creeper ...	Fodder-plant.
Hardenbergia Comptoniana	Blue Kennedya ...	Ornamental climber.
Erythrophloeum Laboucherii	Camel Poison ...	Poison-plant.
Acacia armata	Kangaroo Wattle ...	Ornamental tree.
Acacia acuminata	Jam	Timber used for cabinet work and fencing-posts.
Acacia spp.	Mulga	Wood yields valuable charcoal for producer gas plants.
Albizzia lophantha	Crested Wattle ...	Ornamental tree.
Rhizophoraceæ—		
Ceriops Candolleana ...	Red Mangrove ...	Timber used as fuel by pearlers. Bark contains 45 per cent. tannin.
Bruguiera gymnorrhiza ...	Black Mangrove ...	Bark contains 45 per cent. tannin.
Myrtaceæ—		
Agonis flexuosa	Peppermint-tree ...	Ornamental tree.
Melaleuca Leucadendron ...	Cadjiput	Timber used in the North-West for fence-posts.
Chamaelaucium uncinatum...	Geraldton Wax-plant	Ornamental shrub.
Eucalyptus marginata ...	Jarrah	Ornamental tree. Timber exported for general purposes and used locally for sleepers, piles, fence-posts, as well as for furniture.
Eucalyptus loxophleba ...	York Gum ...	Timber exported and used locally for wagon building.

LIST OF THE PRINCIPAL INDIGENOUS PLANTS, ETC.—*continued.*

Scientific Name.	Vernacular.	Value.
Myrtaceæ- (continued).		
Eucalyptus diversicolor ...	Karri	Timber exported and used locally for many purposes.
Eucalyptus gomphocephala	Tuart	Timber used for railway-trucks, bolsters, heavy wheelwright work, timber-jinkers, etc.
Eucalyptus redunca ...	Wandoo	Timber used for purposes similar to Tuart, also for turnery work and telephone and telegraph insulator pins.
Eucalyptus patens	Blackbutt	Timber used for coach building.
Eucalyptus calophylla ...	Marri (Red Gum)...	Timber used for poles and fetchels of heavy jinkers, etc. Kino used for tanning containing up to 86 per cent. of tannin, also in medicine.
Eucalyptus ficifolia	Scarlet-flowering Gum	Ornamental tree.
Eucalyptus cornuta ...	Yate	Timber used for wagon-work.
Eucalyptus longicornis ...	Morrell	Timber used for coach building and for mine props and fuel on the goldfields.
Eucalyptus salmonophloia ...	Salmon-gum ...	Timber used for mine props and fuel on the goldfields.
Eucalyptus salubris ...	Gimlet	Timber used for mine-props and fuel on the goldfields. Bark contains 18·22 per cent. tannin.
Eucalyptus transcontinentalis	Great Western Gum	Timber used for mine props and fuel on the goldfields.
Eucalyptus Campaspe ...	Silver-topped Gimlet	Timber used for mine props and fuel on the goldfields.
Eucalyptus Clelandi ...	Goldfields Blackbutt	Timber used for fuel on the goldfields.
Eucalyptus torquata ...	Goldfields Flowering Gum	Timber used for fuel on the goldfields.
Eucalyptus calycogona var. gracilis	Snap-and-Rattle ...	Timber used for fuel on the goldfields.
Eucalyptus pyriformis ...	Pear-gum	Timber used for fuel on the goldfields.
Eucalyptus occidentalis var. astringens	Mallett	Bark contains 45 per cent. tannin.
Eucalyptus macrocarpa ...	Macrocarpa-gum ...	Ornamental shrub.
Santalaceæ—		
Fusanus acuminatus ...	Quandong	Fruit used in confectionery.
Santalum cygnorum ...	Sandalwood ...	Timber exported to China and Malaya for manufacture of joss-sticks. Distilled, yielding oil used medicinally.
Ebenaceæ—		
Maba humilis	Australian Ebony	Timber used for cabinet work, walking-sticks, musical instruments, etc.
Loranthaceæ—		
Nuytsia floribunda	W.A. Christmas-tree	Ornamental tree.
Proteaceæ—		
Xylomelum occidentale ...	Native Pear ...	Timber used for cabinet work,.
Banksia verticillata	River Banksia ...	do. do.
Banksia littoralis	Swamp Banksia ...	Timber used for fuel in Perth.
Banksia grandis	Broad-leaved Banksia	do. do.
Banksia Menziesii	Banksia	do. do.
Banksia attenuata	Narrow-leaved Banksia	do. do.
Banksia ilicifolia	Prickly Banksia ...	do. do.
Compositæ—		
Brachycome iberidifolia ...	Swan River Daisy ...	Cultivated for its flowers.
Waitzia aurea	Yellow Everlasting	do. do.
Helipterum roseum	Pink Everlasting ...	do. do.

LIST OF THE PRINCIPAL INDIGENOUS PLANTS, ETC.—*continued.*

Scientific Name.	Vernacular.	Value.
Asclepiadeæ—		
Sarcostemma australe ...	Caustic Vine ...	Poison Plant.
Marsdenia Leichhardtiana ...	Dooba	Aboriginal Food-plant.
Solanaceæ—		
Nicotiana suaveolens ...	Native tobacco ...	Poison-plant and aboriginal narcotic.
Duboisia Hopwoodi	Pituri	do. do.
Myoporinæ—		
Myoporum deserti	Dog-wood Poison ...	Poison-plant.
Hæmodoraceæ—		
Tribonanthes longipetala ...	Jetta	Tuber used as food by aborigines.
Anigozanthus Manglesii ...	Kangaroo-paw ...	Cultivated for its flowers.
Dioscorideæ—		
Dioscorea hastifolia	Yam	Tuber used as food by aborigines.
Liliaceæ—		
Bulbine semibarbata ...	Native Leek ...	Poison-plant.
Stypandra glauca	Blind Grass ...	do.
Xanthorrhœa Preissii ...	Blackboy	Gum used in manufacture of varnishes, etc Distilled, yielding various chemical products.
Xanthorrhœa reflexa ...	Reflexed Blackboy	
Kingia australis	Grass-tree	Flore exported for manufacture of heavy brooms.
Coniferæ—		
Callitris robusta	Cypress Pine ...	Timber used for fence posts in the Kimberley division.
Callitris glauca	Desert Cypress Pine	Timber used for fence posts on the Eastern Goldfields and in the Murchison districts.
Rhizospermæ—		
Marsilea Drummondii ...	Nardoo	Aboriginal food-plant

LIST OF NATURALISED ALIENS AND WEEDS.

Fumaria officinalis	Fumitory
Reseda Luteola	Yellow-weed
Barbarea praecox (B. vulgaris) ...	Early watercress
Sisymbrium officinale	Hedge Mustard
Sinapis arvensis	Charlock
Capsella Bursa-pastoris	Shepherd's Purse
Cakile maritima	Sea Rocket
Raphanus Raphanistrum	Wild Radish
Silene gallica	French Campion
Dianthus prolifer	Proliferous Pink
Saponaria vaccaria	Cow Soapwort
Spergula arvensis	Corn Spurry
Cerastium vulgatum	Mouse-ear Chickweed
Stellaria media	Chickweed
Malva rotundifolia	Marsh-mallow
Geranium molle	Dove's Foot Geranium
Erodium moschatum	"Wild Geranium"
Pelargonium graveolens	Rose Geranium
Oxalis cernua	"Sorrel"
Trifolium procumbens	Hop Clover
Trifolium dubium	Lesser Clover

LIST OF NATURALISED ALIENS AND WEEDS—*continued.*

Trifolium fragiferum	Strawberry Clover
Trifolium tomentosum	Woolly Clover
Trifolium repens	White or Dutch Clover
Trifolium glomeratum	Clustered Clover
Trifolium subterraneum	Subterranean Clover
Trifolium medium	Mammoth Clover
Trifolium pratense	Red Clover
Trifolium arvense	Hare's-foot Clover
Trifolium striatum	Knotted Clover
Trifolium incarnatum	Crimson Clover
Melilotus parviflora	King Island Melilot
Medicago lupulina	Black Medick
Medicago sativa	Lucerne
Medicago maculata	Spotted Medick
Medicago denticulata	Burr Clover
Vicia sativa	Common Vetch
Vicia sepium	Bush Vetch
Lupinus hirsutus	Blue Lupine
Rubus fruticosus	Blackberry
Rosa rubiginosa	Sweetbriar
Oenothera odorata	Evening Primrose
Cucumis myriscarpus	Wild Melon
Opuntia monacantha	Prickly Pear
Senecio vulgaris	Groundsel
Erigeron linifolius	Flax-leaved Fleabane
Inula graveolens	Stinkwort
Cryptostemma calendulaceum ...	Cape Weed
Tripteris clandestina	Stinking Roger
Onopordon Acanthium	Scotch Thistle
Carduus marianus	Milk Thistle
Carduus lanceolatus	Spear Thistle
Kentrophyllum lanatum	Woolly Star Thistle
Centaurea solstitialis	Yellow Cockspur
Cichorium Intybus	Chicory
Hypochaeris radicata...	Rooted Cat's Ear
Taraxacum officinale	Dandelion
Sonchus oleraceus	Sow Thistle
Sonchus asper	Rough Sow Thistle
Xanthium spinosum	Bathurst Burr
Xanthium strumarium	Noogoora Burr
Anagallis arvensis	Pimpernel
Olea europaea	Olive
Gomphocarpus fruticosus	Cotton Bush
Erythraea Centaurium	Centaury
Cuscuta europaea	Dodder
Echium plantagineum	Paterson's Curse
Solanum sodomeaum	Apple of Sodom
Solanum nigrum	Black Nightshade (poisonous)
Lycium Horridum	African Boxthorn
Datura Stramonium	Thorn Apple (poisonous)
Nicotiana glauca	Tree Tobacco
Linaria elatine	Pointed Toadflax
Bartsia latifolia	Broad-leaved Bartsia
Mentha Pulegium	Pennyroyal
Marrubium vulgare	Horehound
Stachys arvensis	Woundwort
Plantago lanceolata	Rib grass
Chenopodium murale	Nettle-leaved Goosefoot
Chenopodium album	Fat-hen

LIST OF NATURALISED ALIENS AND WEEDS *-continued.*

Rumex Acetosella	Sheep Sorrel
Rumex pulcher	Fiddle Dock
Rumex conglomeratus	Clustered Dock
Rumex crispus	Curled Dock
Emex australis	Double-gee
Polygonum aviculare	Wire Weed
Euphorbia Peplus	Petty Spurge
Euphorbia terracina	Carnation Weed
Ricinus communis	Castor Oil (poisonous)
Urtica urens	Stinging Nettle
Asphodelus fistulosus	Onion Weed
Watsonia angusta	Watsonia
Romulea rosea	Guildford Grass
Homeria collina	One-leaved Cape Tulip (poisonous)
Homeria miniata	Two-leaved Cape Tulip (poisonous)
Juncus capitatus	Capitate Rush
Cyperus rotundus	Nut Grass
Panicum sanguinale	Crab Grass
Panicum crus-galli	Barnyard Grass
Paspalum distichum	Water couch
Paspalum dilatatum	Golden Crown Grass
Chloris gayana	Rhodes Grass
Cynodon Dactylon	Couch Grass
Hordeum murinum	Barley Grass
Phalaris canariensis	Canary Grass
Polypogon monspeliensis	Annual Beard Grass
Andropogon halepensis	Johnson Grass
Oryzopsis miliacea	Many-flowered Millet Grass
Agrostis alba	Red Top
Ehrharta longiflora	Veldt Grass
Ehrharta calycina	Veldt Grass
Holcus lanatus	Yorkshire Fog Grass
Lolium temulentum	Drake
Lolium perenne	Rye Grass
Lolium Italicum	Italian Rye-grass
Triticum sativum	Wheat
Secale cerale	Rye
Avena fatura	Wild Oat
Avena sativa	Oat
Aira caryophyllea	Fairy Grass
Aira minuta	Fairy Grass
Bromus moximus	Great Brome
Bromus sterilis	Sterile Brome
Bromus madritensis	Madrid Brome
Bromus anioloides	Prairie Grass
Bromus mollis	Soft Brome
Briza minor	Shivery Grass
Festuca bromoides	Fescue
Dactylis glomerata	Cocksfoot
Poa annua	Annual Meadow Grass

REPORTS ON EXCURSIONS.

EXCURSION TO PERRY'S LIME-KILNS.

16th August, 1919.

A party of 15 members and friends assembled at Subiaco at 1.15 p.m. and walked thence, *via* Jolimont, to Perry's old homestead.

Soon after leaving Jolimont a number of specimens of the Potato-orchid (*Lyperanthus nigricans*) were obtained. On the small bushes of *Hibbertia hypericoides*, which were bright with their yellow flowers, large numbers of the little metallic green Cockchafer (*Diphucephala* sp.,) were found. The bushes were also frequented by the small copper-coloured Burnet Moth (*Procris amethystina*), two of which were found to have been captured by the leaves of a species of *Drosera*.

On arrival at Perry's the party was joined by some more members who had motored out, and the majority then ascended the hill, examining the quarries cut in the æolian limestone on the way up. From the summit of One-tree Hill, which is the highest point in the neighbourhood, an excellent view of Major Brearley's exhibition of flying in progress over the Claremont Show Ground was obtained, and the party watched his aerial evolutions with great interest.

The fine panorama extending from the Darling Ranges to Rottnest and embracing views of portions of the Swan River and Herdsman's Lake was admired, and the chief features of the physiography of the region explained by Dr. Simpson.

The vegetation of the slopes of the hill was found to be somewhat different from that of the sandy country traversed en route, probably due to the influence of the limestone. Bushes of *Acacia cuneata*, with its curious triangular phyllodes, were in full flower. *Hibbertia polystachya*, *Candollea pedunculata*, *Diplopeltis huegelii* and *Olax benthamiana* were also gathered, whilst the bushes were covered with the two common twining plants, *Herdenbergia comptoniana* and *Clematis aristata*.

The thick cover afforded by the luxurious growth of shrubs on the slopes of the hills was evidently a favoured haunt of birds, as the air was full of their notes, though comparatively few were seen. The song of the Brown Honeyeater appeared to predominate. Tawny Admiral butterflies (*Pyrameis itea*) were also noticed flying round the summit of the hill.

Afternoon tea was enjoyed at the camping ground near the old homestead, from which a grassy slope stretches down to a sheet of water. On the latter a pair of Black Swans, several Black Ducks, a flock of White-eyed Ducks and numerous Dabchicks were observed, whilst White-faced Herons patrolled the banks.

After tea the party divided, the majority returning direct by road, whilst eight walked across the bush to West Subiaco station. On the smaller swamp south of the main sheet of water Musk Ducks and Coots were seen, and the Reed Warbler was heard singing; whilst in the walk through the bush Squeakers (*Strepera plumbea*) were disturbed. A small Red-gum tree (*Eucalyptus calophylla*) with exceptionally large fruits was noticed and several more species of wild-flowers were met with. The party reached the station in time to catch the 5.56 train to Perth.

The weather, after a threatening morning, turned out beautiful, though perhaps rather warm for walking.

W. B. Alexander (Leader).

EXCURSION TO GINGIN.

13th September, 1919.

An all day excursion was made to Gingin on Saturday, 13th September, under the leadership of Dr. E. S. Simpson.

Leaving Perth at 8 a.m. the party, numbering 20 members and friends, reached Gingin at 10.45. The main object of the visit was to examine the cretaceous rocks which occupy this district and collect fossils and minerals embedded in them.

Passing up over the shales which outcrop near the station the party climbed Molecap Hill, the sides of which, above the shales, are formed of the sandy soil resulting from the disintegration of the Lower Greensand. The summit of the hill is formed of a thin bed of chalk extending over several acres of ground. This chalk has been opened up by Mr. W. B. Gordon, with whose help a number of fossils were collected from the chalk and several phosphate nodules from the underlying greensand. The fossils included, besides innumerable microscopic foraminifera and sponges, several large foraminifera (*Nodosaria, Cristellaria*, etc.); many echinid spines; four brachiopods (*Trigonosemus, Magas, Magasella*, and *Terebratulina*); some lamellibranchs, especially Inoceramus, the fibrous fragments of which were the most common fossil observed; a gasteropod (*Tubulostium*); an ammonite; an annelid (*Spirulaea*); the tooth of a shark (*Lamna*); and several fossils as yet unclassified. Several of the latter appear not to have been recorded previously from this locality.

The minerals observed at Molecap Hill were: Calcite, quartz, glauconite (abundant in the greensand, common in the chalk); and nodular fluorapatite in the greensand immediately below the chalk.

After lunch besides the stream immediately east of Molecap, the party proceeded eastwards, collecting botanical specimens and observing the geological structure. Underfoot during this part of

the excursion was the Upper Greensand overlying the chalk. Most noticeable was the conversion of the uppermost layer of the greensand into a hard siliceous ironstone by lateritic action. A final halt was made at Mr. Philbey's workings on the chalk and greensand, about 2^1_2 miles east of Gingin. No fossils were collected here, but the minerals were of the greatest interest. From the dump of a small shaft in the Upper Greensand many specimens of the very rare Gearksutite ($CaF_2.AlF_2OH.H_2O$) were obtained, whilst nodular fluorapatite was found to be widely disseminated in chalk and upper greensand.

On the return journey to the station the abundant development of pebbles of ferruginous gibbsite over the outcrop of the shales could not fail to be noticed.

E. S. Simpson (Leader).

EXCURSION TO LAKE YANGEBUP.

14th October, 1919.

An excursion was held to Lake Yangebup, which is about a mile south-west of Bibra Siding, about twenty-five being present. It was the original intention to circumnavigate the lake, but delay on the railway journey cut the time short, and only a portion of the eastern shore was examined. Yangebup is one of the swamps of the chain which runs north and south parallel to the coast, through the limestone hills. The flora of this country is typical, one of the most noticeable members being the Tuart (*Eucalyptus gomphocephala*), which is confined to the coastal limestone belt. The other Eucalypts noticed were the Jarrah (*Eucalyptus marginata*), which was blossoming in a number of cases, the Red Gum (*E. calophylla*) which is the most widely distributed of our Western gums, and the Swamp Gum (*E. rudis*). The latter was growing in some cases in a foot or more of water without apparent discomfort.

Acacia cyanophylla and *A. pulchella* were in full bloom, and a large number of seedlings of the latter were noticed where the bush fires had swept through the bush. The seeds of this and other species of Acacia have a wax-impregnated outer layer of cells which prevents entry of water without which germination cannot take place. The fires have the effect of charring this coat and the seed then absorbs water and germinates. The same thing may be observed in King's Park, where *Oxylobium capitatum* is thriving in areas which have been burnt out. Orchids were represented by *Caladenia Patersonii, C. discoidea, C. flava,* and *Thelymitra ixioides,* Amongst other plants seen flowering were *Macarthuria australis, Hovea pungens, Kennedya prostrarta* (an excellent native fodder plant), *Clematis aristata, Hardenbergia monophylla,* and *Burchardia umbellata.*

Several large vineyards were passed on the way to Bibra Siding in the train, and it is of interest that anthracnose or black spot (a fungal disease due to *Sphaceloma ampelina*), is absent in this limestone country. This disease is common in the hills, whence affected plants have been introduced to this locality. In all cases the disease has disappeared.

D. A. Herbert (Leader).

EXCURSION FROM SWAN VIEW TO DARLINGTON.

18th October, 1919.

The members of the Royal Society who attended this excursion proceeded by the 1.35 p.m. train to Swan View. Starting from this station at about 2.40 p.m. they made their way in a S.S.E. direction. The weather was cloudy, and the day cool for the time of the year — conditions just suitable for a scramble over the hills. The distance from Swan View to Darlington across the Range is about three miles. For two miles we made our way upwards, crossing a series of ridges and depressions.

In geological structure the locality is similar to many other parts along the western escarpment of the Darling Range. Pieces of rock lay abundantly around, ranging from small fragments to boulders a ton or more in weight. Several babbling streamlets, here and there forming miniature cascades, were crossed during the afternoon. The panoramic views (changing at every step) of the Swan Valley to the north-west and west were sights not easily forgotten. About a mile from Darlington the land is at its highest, and from thence slopes downwards to the railway line.

At five o'clock the party rested on some logs by the side of a brook and partook of light refreshments. After this a short walk brought them to the railway station with a few minutes to spare.

I believe the members specially concerned with entomology and geology had a good time, but my interest lay with the wild flowers that grew abundantly all along the way. It seemed wonderful with what profusion they grew between the pieces of rock, often closer together than in clearer spaces. As one member enthusiastically said, "It's a botanist's Paradise."

Although the travelling was somewhat hurried I noted over a hundred plants, representatives of about thirty natural orders. This number would probably be doubled if time allowed for a more careful investigation. The orders best represented were:—Orchideæ (16 specimens), Leguminosæ (16), Proteaceæ (13), Liliaceæ (9), Compositæ (7), Myrtaceæ (6), and Stylideæ (6).

As a kind of supplement to these few notes I append the names, classes, and orders of nearly all the flowers I observed. They may be of some use to young students of botany, showing when and where they may be found in full bloom.

A. J. HALL (Leader).

Specimens noted on the excursion from Swan View to Darlington, Saturday, 18th October:

Orchideæ—
1. Thelymitra crinita
2. Thelymitra fusco-lutea
3. Diuris emarginata
4. Prasophyllum elatum
5. Prasophyllum macrostachyum
6. Prasophyllum fimbrium
7. Microtis porrifolia
8. Lyperanthus nigricans
9. Lyperanthus suaveolens (?)
10. Caladenia Patersoni
11. Caladenia Gemmata
12. Caladenia flava
13. Caladenia Menziesii
14. Caladenia paniculata
15. Glossodia Brunonis
16. Glossodia emarginata

Leguminosæ -
17. Gastrolobium spinosum
18. Gastrolobium spathulatum
19. Mirbelia spinosa
20. Gompholobium Shuttleworthii
21. Gompholobium polymorphum
22. Burtonia pulchella
23. Jacksonia Sternbergiana (?)
24. Jacksonia
25. Sphærolobium
26. Daviesia cordata
27. Pultenæa ericifolia
28. Hovea chroizemifolia
29. Kennedya prostrata
30. Kennedya Stirlingii
31. Kennedya coccinea
32. Labichea punctata

Proteaceæ—
33. Petrophila striata
34. Isopogon sphærocephalus
35. Isopogon asper
36. Synaphea petiolaris
37. Conospermum Huegelii
38. Lambertia multiflora
39. Grevillea bipinnatifida

Proteaceæ (continued)—
40. Grevillea quercifolia
41. Grevillea Synapheæ
42. Hakea lissocarpha
43. Hakea
44. Dryandra nivea
45. Stirlingia simplex

Liliaceæ -
46. Burchardia umbellata
47. Thysanotus Patersoni
48. Caesia rigidifolia
49. Chamaescilla corymbosa
50. Tricoryne elatior
51. Stypandra glauca
52. Sowerbæa laxiflora
53. Borya nitida
54. Xanthorrhœa gracilis

Compositæ -
55. Brachycome (pink)
56. Aster paucidentatus
57. Helichrysum
58. Craspedia Richea
59. Cryptostemma calendulaceum
60. (Yellow daisy)
61. (Yellow everlasting)

Myrtaceæ -
62. Verticordia Huegelii
63. Verticordia nitens (?)
64. Calythrix Fraseri
65. Hypocalymma robustum
66. Melaleuca trichophylla
67. Calothamnus quadrifidus

Stylideæ (Candolleaceæ)- -
68. Stylidium repens
69. Stylidium bulbiferum
70. Stylidium carnosum
71. Stylidium amœnum
72. Stylidium crassifolium
73. Stylidium

Hæmodoraceæ (Amaryllideæ)—
74. Tribonanthes longipetala
75. Conostylis setosa
76. Conostylis setigera
77. Conostylis aurea
78. Anigozanthos Manglesii

Goodeniaceæ—
79. Dampiera linearis
80. Leschenaultia biloba
81. Scaevola striata
82. Scaevola

Euphorbiaceæ -
83. Poranthera ericifolia
84. Phyllanthus calycinus (m.)
85. Do. do. (f.)

Umbelliferæ -
86. Xanthosia Atkinsoniana
87. Actinotus leucocephalus
88. Eryngium rostratum

Epacrideæ -
89. Lysinema ciliatum
90. Andersonia homalostoma
91. Andersonia sprengelioides

Caryophylleæ -
92. Sileno gallica
93. Dianthus prolifer

Labiatæ—
94. Stachys arvensis
95. Bartsia latifolia

Polygaleæ—
96. Comesperma
97. Fumaria officinalis

Irideæ—
98. Patersonia glabrata
99. Romulea rosea

Dilleniaceæ—
100. Hibbertia

Tremandreæ -
101. Tetratheca nuda

Rutaceæ -
102. Boronia spathulata

Sapindaceæ -
103. Diplopelts Stuartii

Stackhousieæ -
104. Stackhousia

Amarantaceæ -
105. Ptilotus (Trich) Drummondii

Polygonaceæ -
106. Muehlenbeckia adpressa

Thymeleæ
107. Pimelea

Rhamnaceæ -
108. Cryptandra

Campanulaceæ
109. Lobelia

Orobancheæ
110. Orobanche

Filices-
111. Cheilanthes tenuifolia

EXCURSION TO LESMURDIE FALLS.

1st November, 1919.

A party numbering ten visited the Lesmurdie Falls on Saturday, November 1st, walking to the falls from Guppy's Siding and returning by the same route. The day was warm and somewhat oppressive, indicating the approach of summer, but the flowers were still brilliant. In addition to the unrivalled blue of *Leschenaultia biloba* the blue orchid *Thelymitra crinita* helped to brighten the roadsides, the plants being very numerous and every flower wide open in the morning sunshine. By the time the party returned in the afternoon the flowers of this plant had resumed their more usual shut up condition.

The view from the top of the falls extending across the coastal plain to the sea was admired, and the party then descended to the foot of the falls and enjoyed lunch by the stream. A fair amount of water was still coming down the steep rock faces of which the fall is composed, but owing to there being no geologist in the party the members had to content themselves with admiring without full comprehension of the causes which have led to the formation of the peculiar niche in the hillside in which the falls are situated.

After examination of a deserted shaft reputed to be an ancient gold mine, and much turning over of logs and rocks in search of insects, a return was made in more leisurely fashion, plants being collected en route. About the falls the handsome purple-flowered *Melaleuca radula* was the most conspicuous shrub, whilst in the valley at their foot white spikes of *Lhotzkja acutifolia*, pink masses of *Lasiopetalum bracteatum* and the blue-flowered twining *Marianthus coeruleo-punctatus* were among the most showy species. The orchids obtained included *Thelymitra longifolia*, *T. fusco-lutea*, *Caladenia paniculata*, *Glossodia emarginata*, *Microtis alba*, *Diuris setacea*, *and D. pauciflora*. The latter species with its short spike of pale yellow flowers with purple patches towards the centre was a novelty to most of the members present.

A small specimen of the common Worm-snake or Blind Snake, *Typhlops australis*, was found under a log, and amongst other insects the brilliant jewel-beetle, *Stigmodera gratiosa*, and a curious unidentified species of locust with the wings reduced to little scarlet flaps, hidden beneath the small brown elytra, were captured. The male of the latter species is very much smaller than the female. A dipterous fly, showing a striking resemblance to a winged female ant, was also captured.

W. B. Alexander (Leader).

EXCURSION TO GREENMOUNT.

15th November, 1919.

An excursion to Greenmount took place on Saturday, November 15th, the itinerary being from the railway station down to the Helena River on one side of the brook, and back along the other side. A few weeks' spell of dry weather had killed off the annual herbs on the hillside and very little flowering material of the perennials was available. Near the railway station the native flora had been ousted by introduced weeds, mainly Guildford Grass. Here and there patches of the Cape Weed (*Cryptostemma calendulaceum*) still flowered, but for the most part this plant had been killed off by the dry weather. Further from the station where stock and other human agencies had not killed off the native vege-

tation, very few aliens had established themselves, practically the only one being *Anagallis arvensis*, the pimpernel. The predominant form of this species was that with the blue flowers, but a number of red flowered specimens were collected, though no true scarlet forms were observed. *Xanthorrhœa preissii* (the Blackboy) was flowering on the left side of the brook and on the hillside on the right the *Xanthorrhœa* formation consisted almost entirely of the new species, X. *reflexa*. This latter, however, had finished flowering.

Among the plants flowering at the time were *Labichea lanceolata*, *Darwinia citriodora*, *Acacia cyanophylla* (rather late), *Eucalyptus rudis* (the swamp gum), *Bartonia scabra*, *Jacksonia sternbergiana*, *Tetratheca nuda* and *Persoonia angustiflora*. On the banks of the Helena River some excellent examples of the transition of the pinnate leaves of *Acacia cyanophylla* to the flattened phyllodes were observed. These indicate the line of descent of the Black Wattle from a far-off pinnate-leaved ancestor which, as conditions became drier, gradually reduced its leaf surface to reduce its water transpiration, and finally lost all the lamina. The leaf stalk then became flattened and took on assimilatory functions and this is the normal type to-day.

On the flats of the river the native vegetation had been replaced artificially by such fodder plants as *Trifolium repens* (the Dutch Clover), *Paspalum dilatatum*, etc., and a few weeds such as *Bromus sterilis*, but in neglected corners these were being reconquered. A very prevalent fungus on the bark of *Acacia cyanophylla* and on the Swamp Gum was *Schizophyllum commune*, which was about the only *Agaricaceous saprophyte* collected, though *Polyporaceae* were very abundant

The latter part of the excursion was devoted to the extinguishing of a bush fire, the result of the investigation on the part of one of the members into the relative inflammability of *Xanthorrhoea preissii* and X. *reflexa*.

D. A. Herbert (Leader).

EXCURSION TO GARDEN ISLAND.

6th December, 1919.

On Saturday, December 6th, 1919, a party of 16 members and friends left Fremantle about 9.30 by motor boat to explore one of the islands off the coast. As a fairly strong south-westerly breeze was blowing, it was decided to make for Garden Island, and after an uneventful run of about 1¼ hours the whole party safely landed in a sheltered bay at the north end of the island. Before lunch

the company scattered in various directions. Those who ascended the cliffs reported that the cliff tops were covered with grass, whose seed made walking distinctly unpleasant. Others explored the beach in both directions, finding an alternation of sand and limestone rocks. (See Photo. Plate X., p. 57). A party of the handsome Crested Terns were resting on the rocks at the north-west corner of the island, and the presence of Brown-winged Terns (*Onychoprion anaethetus*) hovering over an islet a short distance from the mainland induced the ornithologist to wade out across the reefs. He was rewarded by the discovery of three eggs of this species laid singly under the protection of overhanging ledges of rocks without any attempt at nest-making. A young Silver Gull only partially fledged was also found in a nest amongst the bushes on the top of one of the rock-stacks.

After lunch the majority walked along the sea-beach as far south as the Haycock, the highest hill on the northern part of the island. The view from the summit was pronounced to be well worth the trouble of the ascent, though the atmosphere was not as clear as usual. The whole interior of this part of the island was seen to be thickly covered with cypress pines (Callitris), interlaced with various creepers forming a dense matted jungle. Nearer the coast, on the slopes of the hills, thickets of wattles (*Acacia cyclopis*) with occasional tea-trees (*Melaleuca*) occur, and in places there are open tracts covered mainly with grasses. Here were found growing the daisy-like *Athrixia australis* and the beautiful blue-flowered *Trachymene coerulea*. On the limestone headlands running out to the sea various shrubby plants occur. Two were noticed in flower, namely, the strongly-scented Boronia alata with beautiful light-green pinnate leaves, and a pretty white-flowered labiate, *Westringia rigida*.

Mr. Hall, who specially devoted his attention to the flora, reports having collected 30 different plants representing about 20 orders. In addition to those already mentioned, he identified *Scaevola crassifolia, Rhagodia billardieri, Eremophila Brownii, Phyllacanthus calycinus, Cakile maritima, Leptomeria Preissiana, Tersonia brevipes, Conostylis aurea, Tricoryne elatior, Spinifex hirsuta, Sonchus oleraceus, Solanum nigrum, Centaurea sp., Mesembrianthemum sp., Anisopogon sp., Senecio sp., Conostylis sp., Pelargonium sp., Solanum sp.*, and *Thomasia sp.*

The north-western shores of the island are fringed with reefs which were not exposed during our visit and are probably only laid bare by exceptionally low tides. These reefs are chiefly covered with thick growths of Sea-grasses (*Fluviales*), the two common species being *Cymodocea antarctica* and *Posidonia australis*. A fringe along the beach consisted of fruits of the latter species containing in some cases the large seeds with a germinating seedling.

On the bases of the leaves where they were hidden in the sand were found numerous chitons, doubtless of the genus *Stenochiton*, of which Mr. E. Ashby has recently published an interesting account in the Proc. Roy. Soc. S. Australia, 1918. He has discovered that the various species of the genus live on sea-grasses and are only accidentally found elsewhere. Those collected at Garden Island probably belong to the two species *S. jugolides* and *S. posidoniatis*.

In some small rock pools larvæ and pupæ of a species of mosquito were observed flourishing in the salt water, whilst on the surface of one pool great numbers of a Springtail, of the family *Poduridae*, were found.

About 6 o'clock the party left the island with regret and with a following breeze made a speedy run back to Fremantle, escorted for part of the journey by a playful dolphin.

W. B. Alexander (Leader).

Plate X.

Limestone Arch at North end of Garden Island.
(Photo. by Miss Enid Allum.

INDEX.

	Page
Aboriginal Names of Animals	37
Alexander, W. B., on Aboriginal Names of Animals in Lyons River District	37
Alexander, W. B., on Western Australian Lampreys	21
Blackboy—A new species of	33
Boulders, possibly glaciated, near Leonora and Laverton	27
Cheel, Edwin, on a new species of Daviesia	35
Clarke, E. de C., on Boulders, possibly glaciated, near Leonora and Laverton	27
Daviesia—A new species of	35
Excursions—Reports on	47–57
Garden Island—Excursion to	55
Garden Island—Limestone arch on	57
Gingin—Chalk pit near	48
Greenmount—Botanical excursion	53
Herbert, D. A., on climbing of waterfall by Lampreys	23
Herbert, D. A., on Xanthorrhoea Reflexa	33
Indigenous Plants of economic importance in Western Australia ...	41
Lake Yangebup	49
Lampreys climbing a waterfall	23
Lampreys in Western Australia	21–24
Lesmurdie Falls	53
Limestone arch on Garden Island	57
Lyons River District—Aboriginal Names of Animals in	37
Maitland, A. Gibb—Note on Mr. E. de C. Clarke's Paper on Glaciated Boulders	29
Molecap Hill Chalk Pit	48
Naturalised Alien Plants and Weeds in Western Australia	41
Perry's Lime Kilns	47
Physiography of Lower Swan Valley	7
Raised beaches in Swan River Valley	8–13
Swan Valley—Physiography of	7
Swan View to Darlington—Botanical Excursion	50–52
Somerville, J. L., on Evidences of Uplift in the neighbourhood of Perth	5–20
Uplift in the neighbourhood of Perth	5–20
Vernacular Names of Indigenous Plants and Naturalised Aliens and Weeds in Western Australia	41
Xanthorrhoea Reflexa—A new species of Blackboy	33

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